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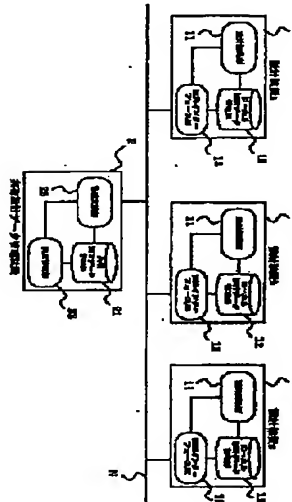
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(54) 【発明の名称】 協調設計支援システム

(57) 【要約】

【課題】 互いに関連する設計データについて各設計者が同時並行して設計作業を進めることができ、各設計者の意図に沿った形で設計データの更新が行われる協調設計支援システムを提供する。

【解決手段】 ネットワークNを介して接続された各設計装置1で編集した設計データはそれぞれローカル設計データ管理部12で個別管理するとともに、共有設計データ管理部21で統合管理して各設計装置1で共通に参照可能とし、共有設計データ管理部21により管理される設計データを更新する場合には、その更新履歴を履歴管理部22で管理する。そして、協調支援部23が各設計装置1が個別管理する設計データと共有設計データ管理部21が統合管理する設計データとの整合性を管理しており、これら設計データ間に不整合が発生した場合には履歴管理部22が管理する更新履歴に基づいて共有設計データ管理部21が統合管理する設計データと各ローカル設計データ管理部12が個別管理する設計データとを整合性がとれる時点まで戻させる。



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## 【特許請求の範囲】

【請求項1】 複数の設計装置をネットワークを介して接続し、それぞれの設計装置で編集した設計データをそれぞれの設計装置で個別管理するとともに共有設計データ管理部で統合管理して各設計装置で共通に参照可能とした協調設計支援システムにおいて、共有設計データ管理部により管理される設計データの更新履歴を管理する履歴管理部と、各設計装置が個別管理する設計データと共有設計データ管理部が統合管理する設計データとの整合を管理し、不整合が発生した場合には履歴管理部が管理する更新履歴に基づいて共有設計データ管理部が統合管理する設計データと各設計装置が個別管理する設計データとを整合性がとれる時点まで戻させる協調支援部と、を備えたことを特徴とする協調設計支援システム。

【請求項2】 請求項1に記載の協調設計支援システムにおいて、

共有設計データ管理部は、設計データの項目毎に各設計装置が編集した設計データの更新権を、更新の優先権を持つ装置、更新の権利を持つ装置、に分けて管理し、協調支援部は、設計装置からの設計データ更新要求に対して、更新要求を免した設計装置が前記いずれの更新権かを判定し、優先権を持つ装置の場合には直ちに共有設計データ管理部が管理する設計データを更新させる一方、更新の権利を持つ装置の場合には当該設計データを参照する他の設計装置からの更新の承認を得た後に共有設計データ管理部が管理する設計データを更新させることを特徴とする協調設計支援システム。

【請求項3】 請求項2に記載の協調設計支援システムにおいて、

協調支援部は、更新の優先権を持つ設計装置からの設計データ更新要求に対して当該設計データを参照する他の設計装置への問合せを行い、前記他の設計装置からの承認が得られない場合には、前記更新を取り消すとともに更新取り消しのメッセージを当該更新を要求した設計装置に通知して個別管理する設計データを更新前の内容に戻させることを特徴とする協調設計支援システム。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、複数の設計者がネットワークで接続された複数の設計装置を用いて同時並行して設計を進めることを支援する協調設計支援システムに関する。

【0002】

【従来の技術】 ネットワークで接続された複数の設計装置（設計ツール）を用いて、複数の設計者が同時並行して設計を進める場合には、各設計者が新規作成や訂正等を行って編集した設計データ（設計内容）間の整合をとるために、各設計装置で編集された設計データを他の設計装置へ伝達する必要がある。このような設計データの

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伝達は、従来においては、設計フェーズ毎に文書やCADデータの形で行われていたが、これでは効率が悪いため、設計の進行に並行して設計装置間で自動的に伝達する方式が提案されている。

【0003】 例えば、特開平8-176084号公報には、全ての設計ツールで用いる設計データを一元管理する統合データベース管理装置を設け、全ての設計ツールに統合データベース管理装置をアクセスさせることで、設計データの重複をなくするとともに設計データ間の不整合の発生をなくす実装設計支援装置が提案されている。また、特開平5-12354号公報には、各設計装置により設計データが編集されると、予め設定した制約に基づいて、共有データベース上の関連する設計データを連動修正して設計データ間の協調を図る協調型設計管理ネットワークシステムが提案されている。

【0004】

【発明が解決しようとする課題】 しかしながら、上記した実装設計支援装置にあっては、設計データ間の不整合を防ぐために、或る設計ツールで設計作業を行っている間は他の設計ツールが編集対象としている設計データは他の設計ツールからは更新できなくする必要があった。このため、或る設計ツールによって設計作業を行っている間は、他の設計ツールでは設計データが干渉しない範囲の設計を同時に進めることはできるが、干渉する範囲の設計データに関する設計作業は中断する必要があり、効率的な協調設計作業は行えなかった。また、上記した協調型設計管理ネットワークシステムにあっては、制約に基づいた自動的な更新処理が行われるため、設計者が意図しない設計データの更新が他の設計ツールから行われて設計者に混乱を生じさせるばかりか、制約の設計の仕方によっては、本来データ領域の重ならない設計データの範囲にまで修正が及んでしまうという問題があった。

【0005】 本発明は上記従来の事情に鑑みなされたもので、互いに関連する設計データについても各設計者が同時並行して設計作業を進めることができる協調設計支援システムを提供することを目的とする。また、本発明は、各設計者の意図に沿った形で設計データの更新が行われる協調設計支援システムを提供することを目的とする。

【0006】

【課題を解決するための手段】 上記の目的を達成するため、本発明の協調設計支援システムでは、ネットワークを介して接続された各設計装置で編集した設計データはそれぞれの設計装置で個別管理するとともに、共有設計データ管理部で統合管理して各設計装置で共通に参照可能とし、共有設計データ管理部により管理される設計データを更新する場合には、その更新履歴を履歴管理部で管理する。そして、協調支援部が各設計装置が個別管理する設計データと共有設計データ管理部が統合管理する

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設計データとの整合を管理しており、これら設計データ間に不整合が発生した場合には履歴管理部が管理する更新履歴に基づいて共有設計データ管理部が統合管理する設計データと各設計装置が個別管理する設計データとを整合性がとれる時点まで戻させる。したがって、互いに関連する設計データについても不整合が発生するまでは、各設計者が同時並行して設計作業を進めることができる。

【0007】また、本発明の協調設計支援システムでは、共有設計データ管理部は、設計データの項目毎に各設計装置が編集した設計データの更新権を、更新の優先権を持つ装置、更新の権利を持つ装置、に分けて管理している。そして、設計装置からの設計データ更新要求に対して、協調支援部は、更新要求を発した設計装置が前記いずれの更新権かを判定し、優先権を持つ装置の場合には直ちに共有設計データ管理部が管理する設計データを更新させる一方、更新の権利を持つ装置の場合には当該設計データを参照する他の設計装置からの更新の承認を得た後に共有設計データ管理部が管理する設計データを更新させる。したがって、優先権を持つ装置に対しては更新した設計データに基づいて直ちに設計作業を継続することを許容するとともに、優先権は有しないが更新の権利を持つ装置に対しては関連する各設計者の意図に沿った形で設計データの更新が行われる。

【0008】また、本発明の協調設計支援システムでは、更に、協調支援部は、更新の優先権を持つ設計装置からの設計データ更新要求に対して当該設計データを参照する他の設計装置への問合せを行い、前記他の設計装置からの承認が得られない場合には、前記更新を取り消すとともに更新取り消しのメッセージを当該更新を要求した設計装置に通知して個別管理する設計データを更新前の内容に戻させる。したがって、優先権を持つ装置に対しても関連する各設計者の意図に沿った形で設計データの更新が行われる。

【0009】

【発明の実施の形態】本発明の一実施例に係る協調設計支援システムを図面を参照して説明する。図1に示すように、本実施例の協調設計支援システムは、複数の設計装置1をネットワークNで接続するとともに、このネットワークNに共有設計データ管理装置2を接続した構成となっている。なお、以下の説明において、個々の設計装置1を区別する必要がある場合には、これら設計装置1を設計装置a、設計装置b、設計装置c、・・・と記載する。

【0010】設計装置1は、設計ツールプログラムがインストールされたパーソナルコンピュータ等によって構成されており、設計データの編集処理を行う設計編集部11と、当該設計装置1が編集担当する設計データを管理蓄積するローカル設計データ管理部12と、設計データ間の協調をとるためのメッセージ交換処理を行う協調

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インターフェース部13と、を備えている。共有設計データ管理装置2は、設計データ管理プログラムがインストールされたパーソナルコンピュータ等によって構成されており、各設計装置1から送られた設計データを各設計装置1が共通に参照可能に管理蓄積する共有設計データ管理部21と、共有設計データ管理部21により管理される設計データの更新の履歴情報を管理する履歴管理部22と、各設計装置1が個別管理する設計データと共有設計データ管理部21が統合管理する設計データとの整合を管理する協調支援部23と、を備えている。

【0011】このような構成の協調設計支援システムを用いて設計を行うにあたっては、各設計者はそれぞれの設計装置1を操作して自分の担当部分の設計作業を行い、設計データの新規作成や変更等といった設計データの編集作業を行う。そして、設計装置1で編集された設計データ間の整合性の担保は、共有設計データ管理装置2によって以下のようにして実現される。各設計装置1は設計データの編集を行うと、当該設計データをローカル設計データ管理部12に格納させるとともに、当該設計データを含めた更新要求メッセージを協調インターフェース部13からネットワークNを介して共有設計データ管理装置2へ送信する。

【0012】この更新要求メッセージは共有設計データ管理装置2の協調支援部23で受理され、協調支援部23が、所定の条件の下に更新要求に含まれた設計データを共有設計データ管理部21が統合管理している設計データに反映させるとともに、関連する他の設計装置1に更新された設計データを添付して更新の可否を問い合わせを行う。なお、これと同時に、更新要求メッセージに含まれた設計データに基づく更新処理の内容が、履歴情報として履歴管理部22に記録される。そして、関連する他の設計装置1は、更新可否の問い合わせに対して更新要求を受け入れられるかどうかを判断し、受け入れられる場合にはローカル設計データ管理部12が個別管理している独自の設計データを更新する一方、受け入れられない場合には更新取り消し要求メッセージを協調支援部23へ返信する。

【0013】この更新取り消し要求メッセージを協調支援部23が受け取った場合には、履歴管理部22が管理している履歴情報に基づいて共有設計データ管理部21が管理蓄積している設計データを元に戻し、関連する設計装置1に更新取り消しのメッセージとともに取り消しに係る更新の履歴情報を送信する。この更新取り消しメッセージを受け取った設計装置1では、更新の履歴情報に基づいてローカル設計データ管理部12で管理している設計データを元に戻し、共有設計データ管理部21が管理蓄積している設計データとの整合性を維持する。

【0014】なお、本実施例では、共有設計データ管理部2が設計データの更新権を管理しており、協調支援部23が設計データの更新要求を発した設計装置1につい

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て更新権に関する優先権を検索し、優先権を持つ場合には、前記と同様に更新要求に含まれた設計データを共有設計データ管理部21が統括管理している設計データに直ちに反映させる。一方、優先権を持たない場合には、優先権を持つ設計装置から更新を了承する応答があったところで共有設計データ管理部21が統括管理している設計データを更新する。これにより、設計責任範囲を無視した無秩序な設計更新を防ぐことができ、設計作業の効率を向上することができる。

【0015】次に、本実施例の協調設計支援システムを電子回路の設計作業を例にとって更に具体的に説明する。なお、機械設計等においても、同様のシステム構成と手順により同様の協調設計を行うことができる。図2には、ローカル設計データ管理部13および共有設計データ管理部21で管理する設計データの一例を示してあり、この設計データは画像処理回路(設計対象)に関するものである。画像処理回路は、イメージセンサー、A/Dコンバータ、画像変換部、ビデオメモリの4つのサブシステムで構成される。そして、例えば画像変換部は、ブロック1、ブロック2、ブロック3で構成され、ブロック2はチップ1、チップ2、チップ3で構成される。なお、画像変換部以外の3つのサブシステムも同様にブロックおよびチップで構成される。

【0016】本実施例では、図2に示した各構成要素を設計オブジェクトと称し、この設計オブジェクトには属性と属性値が含まれている。属性としては、例えば画像変換部の仕様として、コスト、画像変換レート、コスト、カラー深度等がある。この設計オブジェクトは例えば図3に示すように表現でき、画像変換部の設計オブジェクトには、当該オブジェクトの名称“画像変換部”、画像変換部の上位の要素である上位オブジェクトの名称“画像処理回路”、画像変換部の下位の要素である下位オブジェクトの名称“(ブロック1、ブロック2、ブロック3)”、属性および属性値“(コスト:5800、変換レート:30、カラー深度:24)”が含まれている。

【0017】ところで、電子回路についての設計作業の段取りを説明すると、設計作業は通常、基本設計、概略設計、詳細設計、と段階を追って行われる。基本設計段階では、システム全体のサブシステム構成と要求仕様項目の決定を行い、図2に示した画像処理回路の例では、まずトップレベルの画像処理回路の要求仕様を決定し、それを満たすサブシステム構成を決定する。続いて、サブシステムの仕様、それぞれの仕様を満たすブロック構成とその仕様を決定する、という具合にトップダウンにシステムの構成と仕様を決定する。そして、概略設計段階では電子回路のブロックを実現する電子部品を決定し、詳細設計段階では電子部品間の結線とプリント基板上の配置を決定する。

【0018】ところで、設計作業は様々な専門知識を要

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するものであり、一人ですべての設計を行うことは難しい。このため、様々な専門分野に精通した複数の設計者が分担して設計を行うことが多い。画像処理回路の設計においても、例えば、基本設計段階ではシステム全体の仕様とサブシステムの概略仕様をシステム設計者が中心になって決定し、それぞれのサブシステムについてはサブシステムの専門家、すなわち、イメージセンサーの専門家、A/Dコンバータの専門家、画像変換部の専門家などがブロック設計などを行う。

【0019】このように分担した範囲での設計を行う場合には、設計者間で互いに分担する範囲が或る程度重なるのが普通である。例えば、画像変換部の仕様決定に当たっては、仕様決定権を持っているシステム設計者が中心になって仕様を決定するが、回路の実現レベルまで考慮した仕様の検証は画像変換部の専門家でなければ判断できないため、画像変換部の専門家が仕様を変更する場合がある。更に、設計作業を遂行するに際して、自分の設計範囲以外の設計データを参照する必要がある。このため、共有設計データ管理装置2の共有設計データ管理部21では、前述した設計者間の分担範囲や参照範囲を含めて、設計装置a、設計装置b、設計装置cで共有する設計データを管理している。

【0020】設計者間の分担範囲や参照範囲は、具体的には図4に示すように分類して管理されており、各設計者がアクセスし得る設計オブジェクトは、上位から、優先設計オブジェクトと、担当設計オブジェクトと、参照設計オブジェクトとに分類されている。優先設計オブジェクトは設計者が優先的に更新権を持つ設計オブジェクトであり、各設計オブジェクトはいずれか一人の設計者に優先設計オブジェクトとして登録されている。担当設計オブジェクトは設計者が設計担当範囲として更新権をもつ設計オブジェクトであり、優先設計オブジェクトは担当設計オブジェクトでもある。参照設計オブジェクトは設計者が設計作業時に参照する設計オブジェクトであり、担当設計オブジェクトは参照設計オブジェクトでもある。すなわち、担当設計オブジェクトと参照設計オブジェクトは設計者間で重複する。

【0021】図4に示す例では、設計オブジェクト“画像処理回路(全体)”は、すべての設計者が設計更新権を持っており、担当設計オブジェクトとして登録されている。また、設計オブジェクト“A/Dコンバータ”は、システム設計者、A/Dコンバータ設計者、画像処理部設計者が参照するオブジェクトとして登録されている。なお、各設計装置1のローカル設計データ管理部12には、その設計装置1を利用している設計者の参照範囲までの設計オブジェクト(すなわち、優先設計オブジェクト、担当設計オブジェクトおよび参照設計オブジェクト)が管理される。

【0022】共有設計データ管理部21は、例えば図5に示すように、このような設計者間の分担範囲や参照範

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図を設計オブジェクトに対応付けて管理している。図5に示す例は画像交換部についての設計オブジェクトであり、優先設計オブジェクトとして当該設計オブジェクトにアクセスする設計者“A”を優先更新権保持者、担当設計オブジェクトとして当該設計オブジェクトにアクセスする設計者“(A B C)”を更新権保持者、参照設計オブジェクトとして当該設計オブジェクトにアクセスする設計者“(A B C F F)”を参照者として属性に保持している。

【0023】また、履歴管理部22は設計データの更新に関する履歴を管理するために履歴情報を管理しており、履歴情報は各更新要求メッセージ毎の履歴レコードの集合となっている。履歴レコードは、図6に示すように、更新要求メッセージの識別子(メッセージID)、変更、追加、削除などといった更新処理の種類(コマンド)、更新対象の設計オブジェクト名(オブジェクト)、更新された属性値の元の値(古い値)、更新後の属性値(変更値)、更新要求メッセージの発生時刻(タイムスタンプ)を含んでいる。図6に示す履歴レコードの例では、ID“M101”の更新要求メッセージが時刻“11905”に発せられ、設計オブジェクト“画像交換部”の属性“コスト”が“5800”から“4700”へ変更されたことが管理されている。

【0024】次に、本実施例に係る協調設計支援システムの動作を説明する。まず、設計データ間の不整合が発生していない状況では、協調設計支援システムにおいて各設計者は他の設計者のことを意識することなく設計作業を進めることができる。以下の説明では、設計者Aは設計装置aを用い、設計者Bは設計装置bを用い、設計者Cは設計装置cを用いて、各自が設計編集部11を通して設計データの追加、変更、削除などの編集作業を行う。例えば、設計者Aが設計装置aを用いて設計データの編集を行うと、この編集内容は設計装置aのローカル設計データ管理部12に反映されるとともに、協調インタフェース部13から更新要求メッセージによって共有設計データ管理装置2に伝えられる。なお、協調インタフェース部13は、更新要求メッセージを送信した後、共有設計データ管理装置4から仮更新完了、更新完了、更新不可、更新取り消しといった返信メッセージを待つ状態となる。

【0025】更新要求メッセージを受信した共有設計データ管理装置2では、協調支援部23が当該更新要求メッセージを解析して共有設計データ管理部21に保存されている設計データと照合し、更新対象の設計オブジェクトに対する設計装置(すなわち設計装置を利用している設計者)の権利に基づいて、以下の(1)～(3)のいずれかの処理を選択する。

(1) 設計装置が設計オブジェクトに対して優先更新権を持つ場合には、共有設計データ管理部21の内容を更新し、その設計オブジェクトを参照している設計装置に

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更新処理がなされた旨のメッセージを送信する。なお、更新要求メッセージを発した設計装置は、更新処理がなされたため、以後の設計作業を継続して行うことができることとなる。

【0026】(2) 設計装置が設計オブジェクトに対して更新権しか持たない場合には、優先更新権を持つ設計装置に更新要求メッセージを送信し、優先更新権を持つ設計装置が承認した場合にのみ共有設計データ管理部21の内容を更新して、その設計オブジェクトを参照している設計装置に更新処理がなされた旨をメッセージを送信する。なお、承認が得られるまでの間は、メッセージを発した設計装置は設計作業を中断することとなる。

(3) 設計装置が更新権を持たない場合には、更新が認められない旨を更新不可メッセージとして当該設計装置に送信する。なお、このような設計データの更新内容は履歴レコードとして履歴管理部22に保存され、設計データの更新に対して優先更新権を持つ設計装置以外からクレームが付いた場合には、履歴管理部22に保存された履歴レコードを用いて設計データを更新前の内容に戻して再設計を促す。

【0027】図7～図9には、設計データの更新処理に際して送受信される典型的なメッセージの流れを示してある。図7は或る設計オブジェクトに対して優先更新権を持つ設計者Aが更新を行ったときのメッセージの流れであり、設計者Aが設計装置aを用いて行った設計データの更新は更新要求メッセージとして共有設計データ管理装置2に伝えられる。更新要求メッセージを受信した協調支援部23は、共有設計データ管理部21の内容を検索し、設計装置aが更新対象の設計オブジェクトに対して優先更新権を持つと判断すると、そのまま設計データの更新を行い、設計装置aに対して仮更新完了メッセージを返信して設計装置aに設計を継続させる。

【0028】また、共有設計データ管理装置2は、更新対象の設計オブジェクトを参照している他の設計装置bに更新通知メッセージを送信し、設計装置bに更新に対する調整を行わせる。設計装置bは、更新に対する調整が完了した時点で共有設計データ管理装置2に対して更新受け入れメッセージを返信し、共有設計データ管理装置2は更新受け入れメッセージを受け取った時点で更新が完了したとみなして、更新完了メッセージを設計装置aに送信する。すなわち、優先更新権を持つ設計者Aが行った設計データの更新は直ちに共有設計データ管理部21に反映され、当該設計者Aは即座に以後の設計作業を継続することができる。但し、この共有設計データ管理部21での更新は仮の状態であり、関連する他の設計者から更新承諾の確認が得られた時点で確定する。

【0029】図8は設計者Aが設計オブジェクトに対して設計更新権しか持たない場合のメッセージの流れであり、設計者Aが設計装置aを用いて行った設計データの更新要求メッセージが共有設計データ管理装置2に伝え

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られると、この更新要求メッセージは優先更新権を持つ設計装置bに伝えられ、設計装置bからの更新受け入れメッセージが返信された時点で共有設計データ管理部21の更新が行われる。但し、この更新は仮の状態であり、設計装置aに対して仮更新完了メッセージを返信して設計装置aに設計を継続させる。

【0030】この後、図7に示した場合と同様に、共有設計データ管理装置2は、更新対象の設計オブジェクトを参照している他の設計装置cに更新通知メッセージを送信し、共有設計データ管理装置2は設計装置cから更新受け入れメッセージを受け取った時点で更新が完了したとみなして、更新完了メッセージを設計装置aに送信する。すなわち、更新権を持つ設計者Aが行った設計データの更新は優先更新権を持つ設計者からの承諾によって共有設計データ管理部21に反映され、当該設計者Aは以後の設計作業を継続することができる。但し、この共有設計データ管理部21での更新は仮の状態であり、関連する他の設計者から更新承諾の確認が得られた時点で確定する。

【0031】図9は設計者Aが設計オブジェクトに対して優先更新権を持っているが、他の設計者から了承を得られなかった場合のメッセージの流れであり、この場合においても図7に示した場合と同様に仮に更新処理がなされる。但し、この場合には、更新通知メッセージを受けた関連する設計装置bが調整を失敗し、更新取り消し要求メッセージを共有設計データ管理装置2に返信すると、これを受けて共有設計データ管理装置2では更新の取り消し処理を行う。

【0032】この更新取り消し処理では、共有設計データ管理部12が保持する設計データは更新要求メッセージを受ける前の元の内容に戻され、更新取り消しメッセージが設計装置aに送信される。この更新取り消しメッセージに基づいて、設計装置aではローカル設計データ管理部12が保持する設計データを設計更新前の状態に戻し、再設計が行われる。なお、設計の更新通知および設計の更新要求に対する調整作業の実施方法としては、設計者にメッセージの内容を提示して設計者が調整を行う方法と、設計装置内に調整ルールを設けて自動処理をする方法とのいずれを採用してもよい。

【0033】次に、更新要求メッセージを受けたときの協調支援部23の処理を図10に示すフローチャートを参照して説明する。協調支援部23は、更新要求メッセージを受け取ると（ステップS1）、当該メッセージに対応する更新対象の設計オブジェクトを共有設計データ管理部21から抽出する（ステップS2）。次いで、更新要求メッセージを発した設計装置以外に更新対象の設計オブジェクトを参照する設計装置がないかを判定する（ステップS3）。この結果、参照する他の設計装置がない場合には、共有設計データ管理部21が管理している設計データを更新した後（ステップS4）、更新要求

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メッセージを発した設計装置に更新完了メッセージを返信して処理を終了する（ステップS5）。

【0034】一方、参照する他の設計装置がある場合には、更新要求メッセージを発した設計装置が更新対象の設計オブジェクトに対して優先更新権を持つかどうかを判定し（ステップS6）、優先更新権を持つ場合には図11に示す優先更新処理を実行する（ステップS7）。また、優先更新権を持たない場合には、更新要求メッセージを発した設計装置が更新対象の設計オブジェクトに対して更新権を持つかどうかを判定し（ステップS8）、更新権を持つ場合には図12に示す非優先更新処理を実行する（ステップS9）。そして、更新要求メッセージを発した設計装置が更新対象の設計オブジェクトに対して優先更新権又は更新権を持たない場合には、当該設計装置へ更新不可メッセージを返信して処理を終了する（ステップS10）。

【0035】図11に示す優先更新処理では、まず更新要求メッセージの内容に従って共有設計データ管理部21の内容を更新した後（ステップS11）、更新要求メッセージを発した設計装置に仮更新完了メッセージを返信する（ステップS12）。次いで、更新対象の設計オブジェクトに対して更新権を持つ全ての設計装置に更新通知メッセージを送信し（ステップS13）、これら設計装置からの返信を受信する（ステップS14）。次いで、これらの返信によって全ての設計装置が更新を承諾しているかを判断し（ステップS15）、承諾されていない場合には図13に示す更新取り消し処理を実行する一方（ステップS16）、承諾されている場合には更新要求メッセージを発した設計装置に更新完了メッセージを送信して処理を終了する（ステップS17）。

【0036】図12に示す非優先更新処理では、まず更新対象の設計オブジェクトに対して優先更新権を持つ設計装置に更新要求メッセージを送信し（ステップS21）、当該更新要求メッセージに対する返信を受信する（ステップS22）。この返信によって優先更新権を持つ設計装置が更新を承諾しているかを判断し（ステップS23）、承諾されていない場合には更新要求メッセージを発した設計装置へ更新不可メッセージを送信して処理を終了する（ステップS24）。一方、承諾されている場合には、上記した優先更新処理（ステップS11～S17）と同一の処理を実行して処理を終了する（ステップS25～S31）。

【0037】図13に示す更新取り消し処理では、履歴管理部22が管理する更新の履歴情報（図6に示した履歴レコードの集合）を用いて、共有設計データ管理部21の内容および関連する設計装置のローカル設計データ管理部12の内容を矛盾なく更新前の状態に戻す処理を行う。なお、図14には履歴管理部22が管理する履歴情報の概念を示してあり、各設計装置1からの更新要求毎の履歴レコード10が時系列で蓄積されて管理され

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る。この更新取り消し処理の説明では、更新取り消しの対象となる履歴レコード10をRとし、実際に更新取り消し処理がなされるまでの間に最新のもののrまで新たな履歴レコードが順次蓄積されているものとする。そして、最新レコードrから履歴レコードRまでに関して更新取り消し処理を行うことにより、履歴レコードRに関する更新処理がなされる前の状態に戻す処理を行う。

【0038】この更新取り消し処理では、まず取消対象の更新処理に対応する履歴レコードを履歴管理部22から抽出して値Rとして設定する(ステップS41)。次いで、取消処理を行う更新処理の履歴レコードの集合を表す変数Lを空のリストに初期化するとともに(ステップS42)、更新取消に対応してローカル設計データ管理部12の内容を更新取消する必要のある設計装置の集合を表す変数Tを空のリストに初期化する(ステップS43)。次いで、最もタイムスタンプの新しい最新の履歴レコードを値rに設定し(ステップS44)、まず、最新の更新レコードrに対応する共有設計データ管理部21の更新処理を取り消す(ステップS45)。

【0039】次いで、この取り消し処理を集合LおよびTに反映させるために、変数Lに取り消した履歴レコードrを加え(ステップS46)、変数Tに取り消した履歴レコードrに係る設計オブジェクトを参照している設計装置名(設計者名)の集合を加える(ステップS47)。そして、変数rの値を取り消した履歴レコードの1つ前の履歴レコードに変更し(ステップS48)、値rと値Rとを時間的に比較する(ステップS49)。この結果、値rが値Rより新しい(最近)である場合には、取消対象の更新要求メッセージに関する履歴レコードまでの間に他の履歴レコードが存在しているので、上記の処理を繰り返し行って(ステップS45～S48)、これらの履歴レコードに関する更新取消処理並びにリストLおよびTへの追加を行う。

【0040】そして、値rが値Rより古くなった場合には、取消対象の更新要求メッセージに関する履歴レコードR以降の全ての履歴レコードに関して、更新取消処理並びにリストLおよびTへの追加がなされたので、リスト変数Tの要素に含まれる全ての設計装置に対して、履歴レコードの集合Lを添付した更新取消メッセージを送信して処理を終了する(ステップS50)。このように、更新取消に関連する全ての設計装置に対して履歴レコードの集合とともに更新取消メッセージを送ることにより、関連する設計装置にローカル設計データ管理部12の内容を矛盾なく更新前の状態に戻させることができる。なお、これらの設計装置では、再設計の際に送信された履歴レコードを再利用することで、効率的な再設計

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を行うことができる。

【0041】

【発明の効果】以上説明したように、本発明に係る協調設計支援システムでは、設計データ間に不整合が発生した場合には履歴管理部が管理する更新履歴に基づいて共有設計データ管理部が統合管理する設計データと各設計装置が個別管理する設計データとを整合性がとれる時点まで戻させるようにしたため、互いに関連する設計データについても不整合が発生するまでは、各設計者が同時並行して設計作業を進めることができる。また、本発明に係る協調設計支援システムでは、設計データの更新を更新権および各設計者からの承諾に基づいて調整するようにしたため、更新した設計データに基づいて設計作業を直ちに継続することを許容するとともに、関連する各設計者の意図に沿った形で設計データの更新を行うことができる。

【図面の簡単な説明】

【図1】 本発明の一実施例に係る協調設計支援システムを示す構成図である。

【図2】 設計データの構造を例示する概念図である。

【図3】 設計オブジェクトの内容を例示する概念図である。

【図4】 更新権の割り当て例を説明する図である。

【図5】 共有設計データ管理部が管理する設計データの内容を例示する概念図である。

【図6】 履歴レコードの内容を例示する概念図である。

【図7】 メッセージの流れを例示する概念図である。

【図8】 メッセージの流れを例示する概念図である。

【図9】 メッセージの流れを例示する概念図である。

【図10】 協調支援部の処理手順の一例を示すフローチャートである。

【図11】 優先更新処理の処理手順の一例を示すフローチャートである。

【図12】 非優先更新処理の処理手順の一例を示すフローチャートである。

【図13】 更新取り消し処理の処理手順の一例を示すフローチャートである。

【図14】 履歴レコードの集合を示す概念図である。

40 【符号の説明】

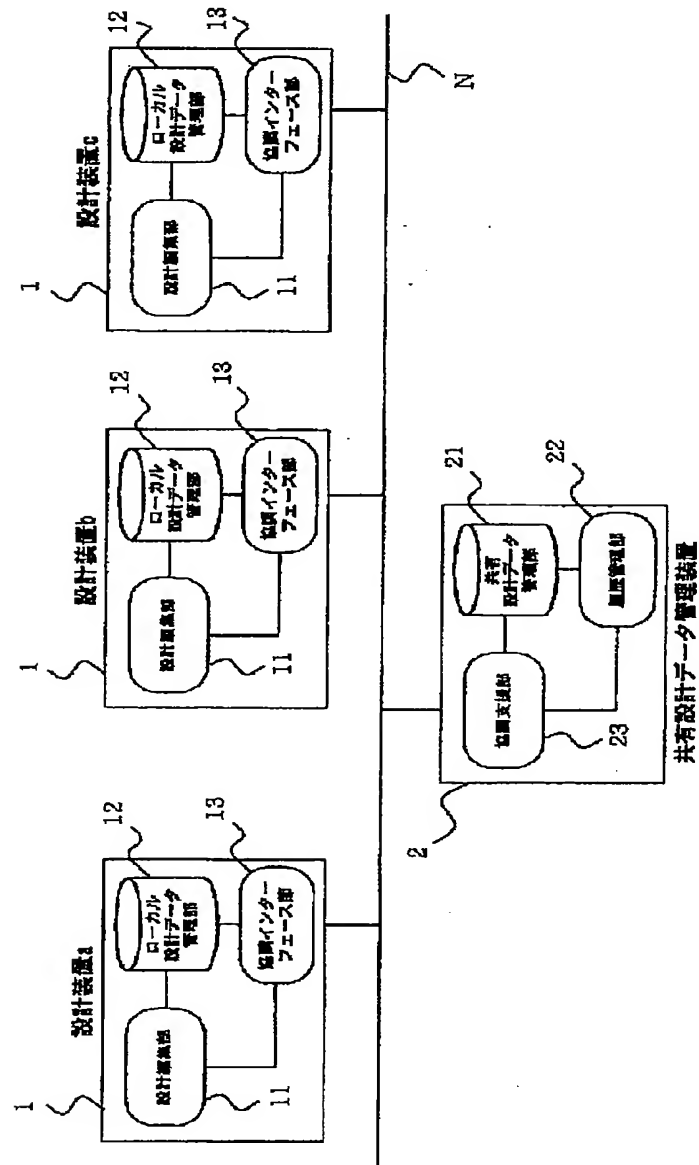
1、a、b、c・・・設計装置、2・・・共有設計データ管理装置、10・・・履歴レコード、11・・・設計編集部、12・・・ローカル設計データ管理部、13・・・協調インターフェース部、21・・・共有設計データ管理部、22・・・履歴管理部、23・・・協調支援部、N・・・ネットワーク、



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【図1】

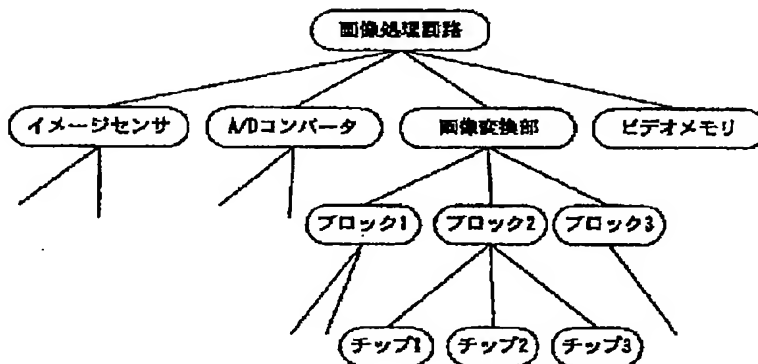




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【図2】



【図6】

メッセージID	M101
コマンド	読取
オブジェクト	画像変換部
属性	コスト
古い値	5800
変更値	4700
タイムスタンプ	110953

【図3】

オブジェクト名	画像変換部
上位オブジェクト	画像処理回路
下位オブジェクト	{ブロック1 ブロック2 ブロック3}
属性	{コスト 5800 変換レート 30 カラー深度 24}

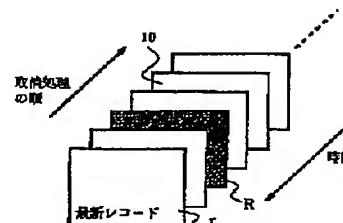
【図4】

設計者	優先設計オブジェクト	担当設計オブジェクト	参照設計オブジェクト
システム設計者	画像処理回路 (全体) イメージセンサ A/Dコンバータ ビデオメモリ	画像処理回路 (全体) イメージセンサ A/Dコンバータ 画像変換部 ビデオメモリ	画像処理回路 (全体) イメージセンサ A/Dコンバータ 画像変換部 ビデオメモリ
イメージセンサ設計者		イメージセンサ 画像処理回路 (全体)	イメージセンサ 画像処理回路 (全体)
A/Dコンバータ設計者		A/Dコンバータ 画像処理回路 (全体)	A/Dコンバータ 画像処理回路 (全体)
画像変換部設計者	画像変換部	画像変換部 画像処理回路 (全体)	画像変換部 画像処理回路 (全体) A/Dコンバータ
ビデオメモリ設計者		ビデオメモリ 画像処理回路 (全体)	ビデオメモリ 画像処理回路 (全体)

【図5】

オブジェクト名	画像変換部
上位オブジェクト	画像処理回路
下位オブジェクト	{ブロック1 ブロック2 ブロック3}
属性	{コスト 5800 変換レート 30 カラー深度 24}
優先更新保持者	A
更新保持者	{A B D}
参照者	{A B C E F}

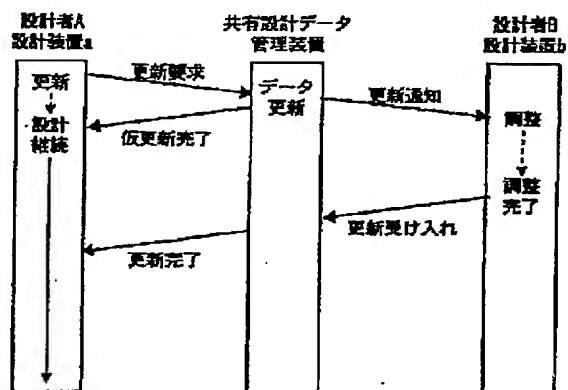
【図14】



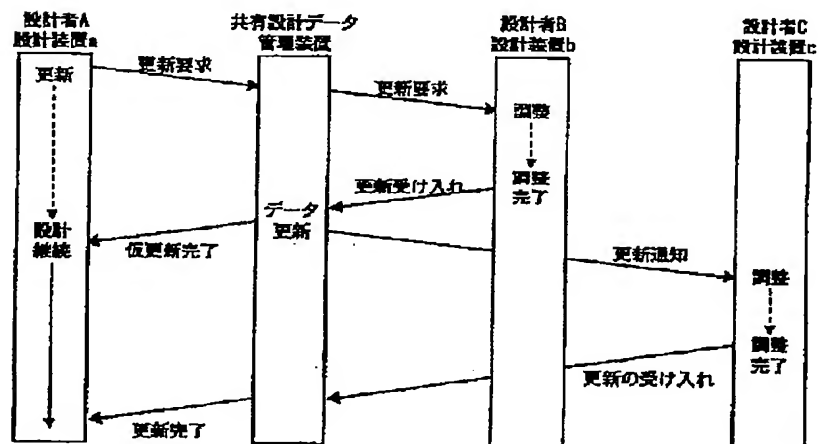
(10)

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【図7】



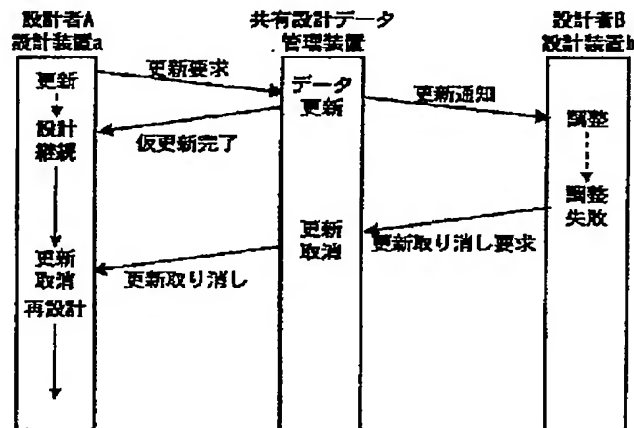
【図8】



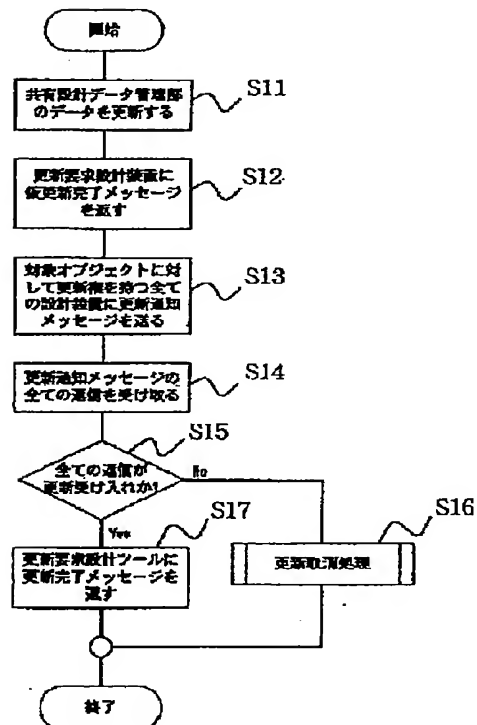
(11)

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【図9】



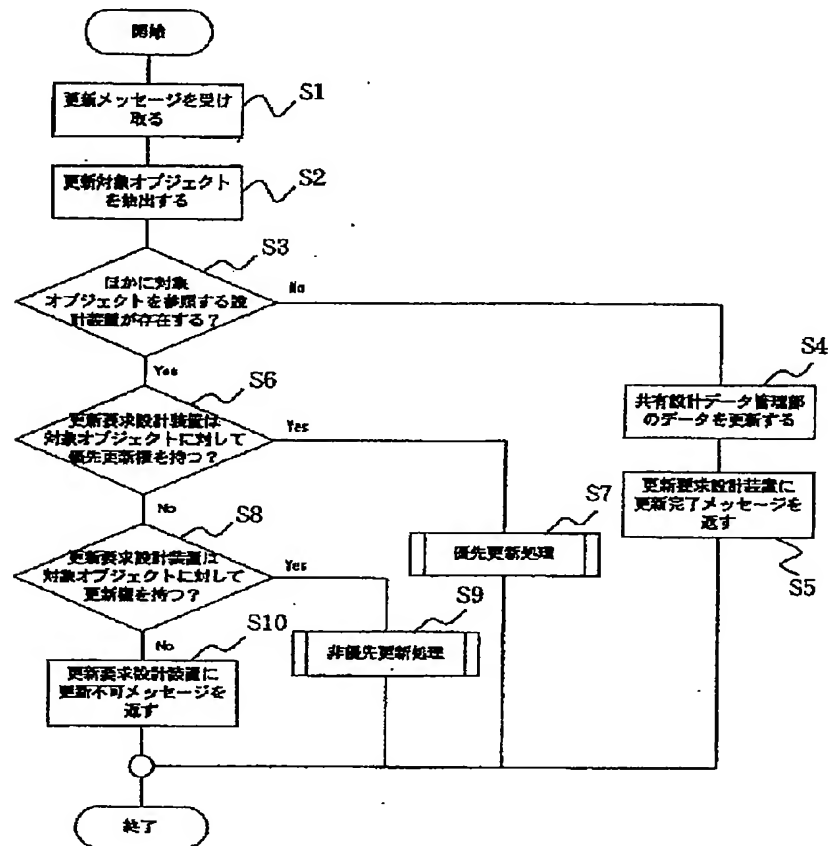
【図11】



(12)

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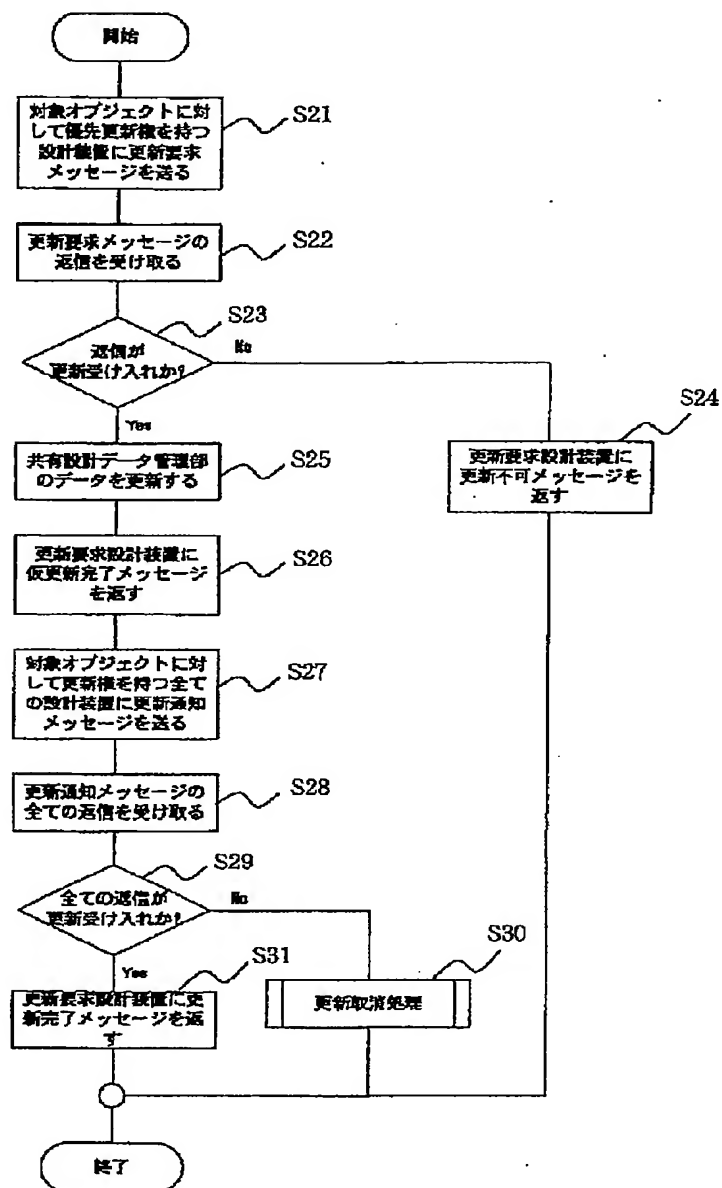
[図10]



(13)

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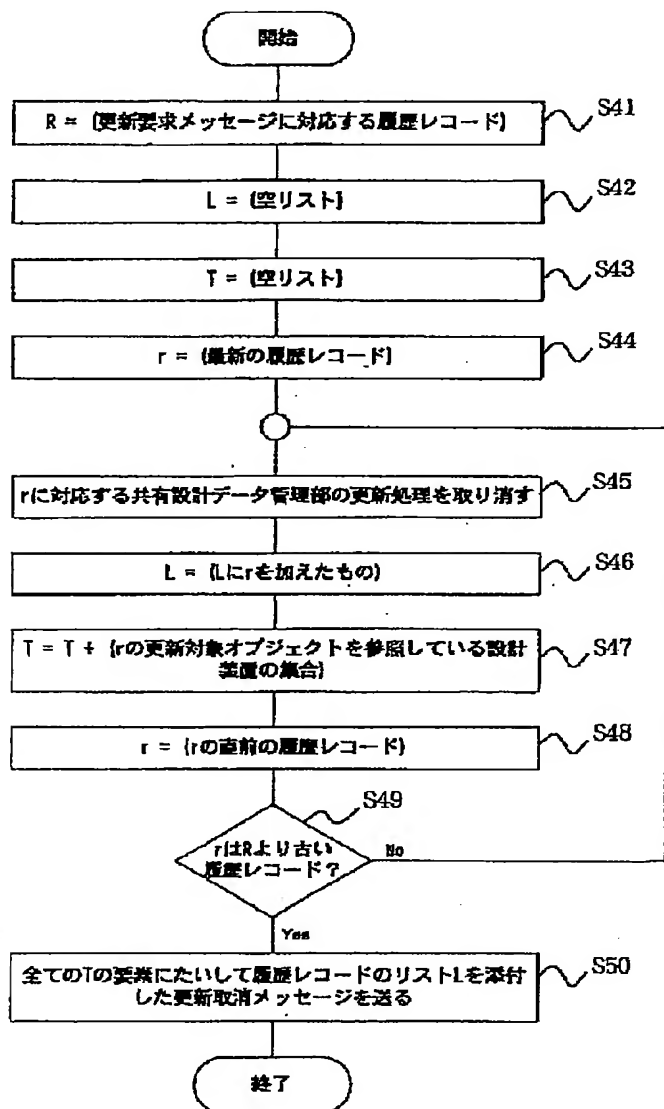
[図12]



(14)

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【図13】



# PATENT ABSTRACTS OF JAPAN

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(71)Applicant : FUJI XEROX CO LTD

(22)Date of filing : 19.04.1996

(72)Inventor : TAKAHASHI HANTAI

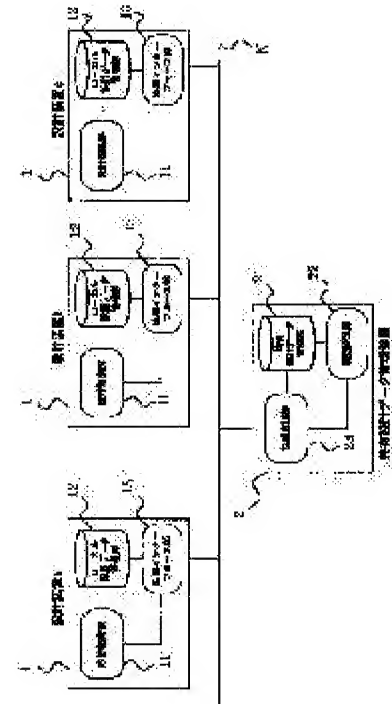
## (54) COOPERATIVE DESIGN SUPPORTING SYSTEM

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a cooperative design supporting system capable of making respective designers able to simultaneously and parallelly advance design work for mutually related design data and updating the design data in a form according to the intention of the respective designers.

**SOLUTION:** The design data edited in respective design devices 1 connected through a network N are respectively individually managed in local design data management parts 12, integrally managed in a shared design data management part 21 and made referable in common in the respective design devices 1. In the case of updating the design data managed by the shared design data management part 21, the updating history is

managed in a history management part 22. Then, a cooperation supporting part 23 manages the matching of the design data individually managed by the respective design devices 1 and the design data integrally managed by the shared design data management part 21, and in the case that inconsistency is generated between the design data, the design data integrally managed by the shared design data management part 21 and the design data individually managed by the respective local design data management parts 12 are returned to the point of time when consistency is attained, based on the updating history managed by the history management part 22.





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**LEGAL STATUS**

[Date of request for examination] 12.12.2000

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[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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- 3.In the drawings, any words are not translated.

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CLAIMS

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[Claim(s)]

[Claim 1] In the coordination computer-aided design in which whose reference carried out integrated management in the share engineering-data-management section, and was enabled in common with each design equipment while carrying out individual management of the design data which connected through the network and edited two or more design equipments with each design equipment with each design equipment With the hysteresis Management Department which manages the updating hysteresis of the design data managed by the share engineering-data-management section Adjustment with the design data in which each design equipment carries out individual management, and the design data in which the share engineering-data-management section carries out integrated management is managed. Coordination computer-aided design characterized by having the coordination exchange section which makes the design data in which the share engineering-data-management section carries out integrated management based on the updating hysteresis which the hysteresis Management Department manages when mismatching occurs, and the design data in which each design equipment carries out individual management return until it can take consistency.

[Claim 2] In coordination computer-aided design according to claim 1 the share engineering-data-management section It divides into the equipment which has the priority of updating for the update rights of the design data which each design equipment edited for every design item, and equipment with the access of updating, and manages. The coordination exchange section The design equipment which emitted the updating demand judges whether they are said which update rights to the renewal demand of a design data from design equipment. While making the design data which the share engineering-data-management section manages promptly update in the case of equipment with priority Coordination computer-aided design characterized by making the design data which the share engineering-data-management section manages after acquiring acknowledgement of updating from other design equipments which refers to the design data concerned in the case of equipment with the access of updating update.

[Claim 3] In coordination computer-aided design according to claim 2 the coordination exchange section When the inquiry to other design equipments which refer to the design data concerned to the renewal demand of a design data from design equipment with the priority of updating is performed and the acknowledgement from design equipment besides the above is not acquired Coordination computer-aided design characterized by making it return to the content before updating the design data which notifies the message of updating cancellation to the design equipment which required the updating concerned, and carries out individual management while canceling said updating.

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[Translation done.]

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- 3.In the drawings, any words are not translated.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the coordination computer-aided design concerning one example of this invention.

[Drawing 2] It is the conceptual diagram which illustrates the structure of a design data.

[Drawing 3] It is the conceptual diagram which illustrates the content of the design object.

[Drawing 4] It is drawing explaining the example of quota of update rights.

[Drawing 5] It is the conceptual diagram which illustrates the content of the design data which the share engineering-data-management section manages.

[Drawing 6] It is the conceptual diagram which illustrates the content of the hysteresis record.

[Drawing 7] It is the conceptual diagram which illustrates the flow of a message.

[Drawing 8] It is the conceptual diagram which illustrates the flow of a message.

[Drawing 9] It is the conceptual diagram which illustrates the flow of a message.

[Drawing 10] It is the flow chart which shows an example of the procedure of the coordination exchange section.

[Drawing 11] It is the flow chart which shows an example of the procedure of a precedence update process.

[Drawing 12] It is the flow chart which shows an example of the procedure of an update process non-giving priority.

[Drawing 13] It is the flow chart which shows an example of the procedure of updating cancellation processing.

[Drawing 14] It is the conceptual diagram showing the set of a hysteresis record.

[Description of Notations]

1 a, b, c ... Design equipment 2 [ 11 / 13 / 22 / N ... Network, / ... The hysteresis Management Department 23 ... Coordination exchange section / ... The coordination interface section, 21 ... Share engineering-data-management section / ... The design editorial department 12 ... Local engineering-data-management section ] ... Share engineering-data-management equipment, 10 ... Hysteresis record

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[Translation done.]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the coordination computer-aided design which supports that two or more architects do a concurrency using two or more design equipments connected in the network, and advance a design.

[0002]

[Description of the Prior Art] When two or more architects do a concurrency and advance a design using two or more design equipments (design tool) connected in the network, in order to take adjustment between the design datas (the content of a design) each architect edited by performing new creation, correction, etc., it is necessary to transmit the design data edited with each design equipment to other design equipments. Although transfer of such a design data was performed in the form of a document or CAD data for every design phase in the former, since effectiveness is bad, now, the method automatically transmitted between design equipment in parallel to progress of a design is proposed.

[0003] For example, the integrated-database management equipment which carries out unitary management of the design data used with all design tools is formed in JP,6-176084,A, and by making integrated-database management equipment access all design tools, while losing the design duplication of data, the packaging-design exchange equipment which abolishes generating of the mismatching between design datas is proposed. Moreover, if a design data is edited by each design equipment, based on the constraint set up beforehand, the coordination die design management network system which makes the interlocking correction of the design data to which it relates on a share database, and aims at coordination between design datas is proposed by JP,5-12354,A.

[0004]

[Problem(s) to be Solved by the Invention] However, if it is in the above-mentioned packaging-design exchange equipment, in order to prevent the mismatching between design datas, while a certain design tool was performing the design, from other design tools, the design data which the design tool makes applicable to edit could not be updated, and needed to be carried out. For this reason, although the design of the range in which a design data does not interfere could be simultaneously advanced in other design tools while a certain design tool was performing the design, the design about the design data of the range in which it interferes needed to be interrupted, and the efficient coordination design activity was not able to be done. Moreover, if it was in the above-mentioned coordination die design management network system, since the automatic update process based on constraint was performed, the problem that correction will reach even the range of a design data in which renewal of the design data which an architect does not mean is performed from other design tools, and a data area originally does not lap with an architect depending on the method of a design about [ producing confusion ] and constraint was.

[0005] It aims at offering the coordination computer-aided design which this invention was made in view of the above-mentioned conventional situation, and each architect can do a concurrency also about the design data related mutually, and can advance a design. Moreover, this invention aims at offering the

coordination computer-aided design to which renewal of a design data is performed in the form where the intention of each architect was met.

[0006]

[Means for Solving the Problem] In order to attain the above-mentioned object, it carries out integrated management in the share engineering-data-management section, and makes reference possible in common with each design equipment while carrying out individual management of the design data edited in the coordination computer-aided design of this invention with each design equipment connected through the network with each design equipment, and in updating the design data managed by the share engineering-data-management section, it manages the updating hysteresis in the hysteresis Management Department. And the coordination exchange section has managed adjustment with the design data in which each design equipment carries out individual management, and the design data in which the share engineering-data-management section carries out integrated management, and it is made to return until it can take in consistency the design data the share engineering-data-management section carries out integrated management based on the updating hysteresis which the hysteresis Management Department manages, and the design data each design equipment carries out individual management, when mismatching occurs among these design datas. Therefore, each architect can do a concurrency and can advance a design until mismatching occurs also about the design data related mutually.

[0007] Moreover, in the coordination computer-aided design of this invention, the share engineering-data-management section was divided into the equipment which has the priority of updating for the update rights of the design data which each design equipment edited for every design item, and equipment with the access of updating, and is managed. And after obtaining acknowledgement of updating from other design equipments which refers to the design data concerned in the case of equipment with the access of updating, the share engineering-data-management section makes the design data manage update, while making the design data which the share engineering-data-management section manages promptly update in the case of the equipment in which the design equipment with which the coordination exchange section emitted an updating demand to the renewal demand of a design data from design equipment judges whether they are which said update rights, and has priority.

Therefore, while permitting continuing a design promptly based on the design data updated to equipment with priority, although it does not have priority, renewal of a design data is performed in the form where the intention of each architect related to equipment with the access of updating was met.

[0008] moreover, the inquiry to other design equipments refer to the design data concerned further at the coordination computer-aided design of this invention to the renewal demand of a design data from the design equipment the coordination exchange section has the priority of updating -- carrying out -- said -- others -- while canceling said updating, it makes return to the content before updating the design data which notifies the message of updating cancellation to the design equipment which required the updating concerned, and carries out individual management, when the acknowledgement from design equipment is not acquired Therefore, renewal of a design data is performed in the form where the intention of each architect related also to equipment with priority was met.

[0009]

[Embodiment of the Invention] The coordination computer-aided design concerning one example of this invention is explained with reference to a drawing. As shown in drawing 1, the coordination computer-aided design of this example has the composition of having connected share engineering-data-management equipment 2 to this network N while connecting two or more design equipments 1 in Network N. In addition, in the following explanation, when each design equipment 1 needs to be distinguished, these design equipment 1 is indicated to be design equipment a, design equipment b, design equipment c, and ...

[0010] Design equipment 1 is constituted by the personal computer with which the design tool program was installed, and it has the design editorial department 11 which performs edit processing of a design data, the local engineering-data-management section 12 which carries out management are recording of the design data in which the design equipment 1 concerned carries out edit charge, and the coordination interface section 13 performed in message switching for taking coordination between design datas.

Share engineering-data-management equipment 2 is constituted by the personal computer with which design data management was installed. The share engineering-data-management section 21 to which each design equipment 1 enables in common management are recording of the reference of the design data sent from each design equipment 1, It has the coordination exchange section 23 which manages adjustment with the hysteresis Management Department 22 which manages the hysteresis information on renewal of the design data managed by the share engineering-data-management section 21, and the design data in which each design equipment 1 carries out individual management and the design data in which the share engineering-data-management section 21 carries out integrated management.

[0011] In designing using the coordination computer-aided design of such a configuration, each architect operates each design equipment 1, performs a design of his part in his duty, and performs the editing task of a design data called new creation, modification, etc. of a design data. And deposit of the consistency between the design datas edited with design equipment 1 is realized as follows by share engineering-data-management equipment 2. Each design equipment 1 transmits an updating demand message including the design data concerned to share engineering-data-management equipment 2 through Network N from the coordination interface section 13 while making the design data concerned store in the local engineering-data-management section 12, when a design data is edited.

[0012] This updating demand message is received in the coordination exchange section 23 of share engineering-data-management equipment 2, and while the coordination exchange section 23 makes the design data contained in the updating demand under predetermined conditions reflect in the design data in which the share engineering-data-management section 21 is carrying out generalization management, the design data updated by other related design equipments 1 is attached, and it asks the propriety of updating. In addition, the content of the update process based on the design data which could come, simultaneously was contained in the updating demand message is recorded on the hysteresis Management Department 22 as hysteresis information. And when accepted, while it judges whether an updating demand is acceptable to an inquiry of updating propriety, and the local engineering-data-management section 12 updates the original design data which is carrying out individual management, other related design equipments 1 answer the coordination exchange section 23 in an updating cancellation demand message, when not accepted.

[0013] When the coordination exchange section 23 receives this updating cancellation demand message, the hysteresis information on updating which returns the design data in which the share engineering-data-management section 21 is carrying out management are recording based on the hysteresis information which the hysteresis Management Department 22 has managed, and relates to cancellation with the message of updating cancellation to related design equipment 1 is transmitted. With the design equipment 1 which received this updating cancellation message, the design data managed in the local engineering-data-management section 12 based on the hysteresis information on updating is returned, and consistency with the design data in which the share engineering-data-management section 21 is carrying out management are recording is maintained.

[0014] In addition, when the share engineering-data-management section 2 has managed the update rights of a design data, the priority about update rights is searched about the design equipment 1 with which the coordination exchange section 23 emitted the updating demand of a design data and it has priority, the share engineering-data-management section 21 makes the design data contained in the updating demand like the above reflect in the design data which is carrying out generalization management promptly in this example. Design data in which the share engineering-data-management section 21 is carrying out generalization management on the other hand in the place with the response which consents to updating from design equipment with priority in not having priority It updates. The disorderly renewal of a design which disregarded the design charge range can be prevented by this, and the effectiveness of a design can be improved.

[0015] Next, the coordination computer-aided design of this example is explained still more concretely taking the case of a design of an electronic circuitry. In addition, also in a machine design etc., the same system configuration and the same procedure can perform the same coordination design. An example of the design data managed in the local engineering-data-management section 13 and the share

engineering-data-management section 21 is shown in drawing 2, and this design data is related with an image-processing circuit (object for a design). An image-processing circuit consists of image sensors, an A/D converter, the image transformation section, and four subsystems of video memory. And the image transformation section consists of block 1, block 2, and block 3, and block 2 consists of a chip 1, a chip 2, and a chip 3, for example. In addition, three subsystems other than the image transformation section consist of a block and a chip similarly.

[0016] In this example, each component shown in drawing 2 is called a design object, and an attribute and attribute value are included in this design object. As an attribute, there are cost, an image transformation rate, cost, color depth, etc., for example as a specification of the image transformation section. This design object For example, <A HREF="/Tokujitu/tjitemdrw.ipdl?N0000=239&N0500=1E\_N/?6=7796?///&N0001=147&N0552=9&N0553=000005" It can express, as shown in TARGET="tjitemdrw"> drawing 3. To the design object of the image transformation section the name "name of image transformation section" and high order object which is element of high order of the image transformation section" image-processing circuit of the object concerned -- " -- image transformation -- the section -- low order -- an element -- it is -- low order -- an object -- a name -- " (block 1, block 2, block 3) -- " -- an attribute -- and -- attribute value -- " (cost 5800, conversion rate 30, color depth 24) -- " -- containing -- having -- \*\*\*\*.

[0017] If here explains housekeeping of the design about an electronic circuitry, a design will usually be performed later on in a design development, outline design, a detail design, and a phase. In a design development phase, the subsystem configuration of the whole system and the decision of a requirement specification item are made, and in the example of the image-processing circuit shown in drawing 2, the requirement specification of a top-level image-processing circuit is determined first, and it opts for the subsystem configuration which fills it. Then, the structure of a system and a specification are determined as condition of determining the block configuration which fulfills the specification of a subsystem, and each specification, and its specification at a top-down. And the electronic parts which realize the block of an electronic circuitry in an outline design phase are determined, and it opts for the connection between electronic parts, and the arrangement on a printed circuit board in a detail-design phase.

[0018] By the way, a design is difficult for requiring various know hows and performing all designs by one person. For this reason, it designs in many cases by two or more architects well versed in various special fields of study assigning. Also in the design of an image-processing circuit, in a design development phase, a system designer takes the lead, and determines a system-wide specification and the outline specification of a subsystem, and the expert of a subsystem, i.e., the expert of image sensors, the expert of an A/D converter, the expert of the image transformation section, etc. perform a block design etc. about each subsystem, for example.

[0019] Thus, when performing a design in the shared range, usually the range mutually shared among architects laps [ certain ] a grade. For example, although a system designer with specification decisive power takes the lead and determines a specification in the specification decision of the image transformation section, since verification of the specification taken into consideration to the implementation level of a circuit cannot be judged if it is not the expert of the image transformation section, the expert of the image transformation section may change a specification. Furthermore, it faces carrying out a design and it is necessary to refer to design datas other than one's design range. For this reason, in the share engineering-data-management section 21 of share engineering-data-management equipment 2, the design datas including the assignment range and reference range between the architects who mentioned above shared with design equipment a, design equipment b, and design equipment c are managed.

[0020] It classifies and the assignment range and reference range between architects are specifically managed, as shown in drawing 4, and the design object which each architect can access is classified into the precedence design object, the design object in its duty, and the reference design object from the high order. A precedence design object is a design object in which an architect has update rights preferentially, and each design object is registered into any one architect as a precedence design object. The design object in its duty is a design object in which an architect has update rights as range for a



design, and a precedence design object is also the design object in its duty. A reference design object is a design object which an architect refers to at the time of a design, and the design object in its duty is also a reference design object. That is, the design object in their duty and a reference design object overlap among architects.

[0021] In the example shown in drawing 4, all architects have design update rights and design object "image-processing circuit (whole)" is registered as a design object in its duty. Moreover, design object "A/D converter" is registered as an object which a system designer, an A/D converter architect, and an image-processing section architect refer to. In addition, the design object (namely, a precedence design object, the design object in its duty, and a reference design object) to the reference range of the architect using the design equipment 1 is managed by the local engineering-data-management section 12 of each design equipment 1.

[0022] The assignment range and reference range between such architects were matched with the design object, and the share engineering-data-management section 21 has managed them, as shown in drawing 5. drawing 5 -- being shown -- an example -- image transformation -- the section -- about -- a design -- an object -- it is -- precedence -- a design -- an object -- \*\*\*\*\* -- being concerned -- a design -- an object -- accessing -- an architect -- " -- A -- " -- precedence -- update rights -- a holder -- charge -- a design -- an object -- \*\*\*\*\* -- being concerned -- a design -- an object -- accessing -- an architect -- " (AB C) -- " -- update rights -- a holder -- reference -- a design -- an object -- \*\*\*\*\* -- being concerned -- a design -- an object -- accessing -- an architect -- " (A B C E F) -- " -- reference -- a person -- \*\* -- carrying out -- an attribute -- holding -- \*\*\*\*.

[0023] Moreover, in order that the hysteresis Management Department 22 may manage the hysteresis about renewal of a design data, hysteresis information is managed, and hysteresis information serves as a set of the hysteresis record for every updating demand message. The hysteresis record contains the class (command) of update processes, such as an identifier (message ID) of an updating demand message, modification, an addition, and deletion, the design object name for updating (object), the original value (old value) of the updated attribute value, the attribute value after updating (modification value), and the generating time of day (time stamp) of an updating demand message, as shown in drawing 6. In the example of the hysteresis record shown in drawing 6, the updating demand message of ID "M101" is emitted by time-of-day "11905", and it is managed that design object "attribute of image transformation section" cost" was changed into "4700" from "5800."

[0024] Next, actuation of the coordination computer-aided design concerning this example is explained. First, a design can be advanced in the situation which the mismatching between design datas has not generated, without each architect being conscious of other architects' thing in coordination computer-aided design. As for Architect A, in Architect B, in the following explanation, each one performs editing tasks, such as an addition of a design data, modification, and deletion, through the design editorial department 11 using design equipment c using design equipment b using design equipment a, as for Architect C. For example, if Architect A edits a design data using design equipment a, this content of edit will be told to share engineering-data-management equipment 2 by the updating demand message from the coordination interface section 13 while it is reflected in the local engineering-data-management section 12 of design equipment a. In addition, the coordination interface section 13 will be in the condition of waiting for reply messages, such as pseudo update completion, the completion of updating, updating improper, and updating cancellation, from share engineering-data-management equipment 4, after transmitting an updating demand message.

[0025] With the share engineering-data-management equipment 2 which received the updating demand message, the coordination exchange section 23 collates with the design data which analyzes the updating demand message concerned and is saved in the share engineering-data-management section 21, and chooses one processing of the following (1) - (3) based on the access of design equipment (namely, architect using design equipment) to the design object for updating.

(1) When design equipment has precedence update rights to a design object, update the content of the share engineering-data-management section 21, and transmit the message of a purport by which the update process was made to the design equipment which is referring to the design object. In addition,

since the update process was made, the design equipment which emitted the updating demand message will continue future designs, and can perform it.

[0026] (2) Transmit an updating demand message to the design equipment which has precedence update rights when design equipment has only update rights to a design object, only when design equipment with precedence update rights recognizes, update the content of the share engineering-data-management section 21, and transmit a message in the purport by which the update process was made by the design equipment which is referring to the design object. In addition, the design equipment which emitted the message until acknowledgement was acquired will interrupt a design.

(3) When design equipment does not have update rights, transmit to the design equipment concerned by making into an updating improper message the purport updating is not accepted to be. In addition, the content of updating of such a design data is saved as a hysteresis record at the hysteresis Management Department 22, when a claim is attached from other than the design equipment which has precedence update rights to renewal of a design data, it is returned to the content before updating a design data using the hysteresis record saved at the hysteresis Management Department 22, and redesign is urged to it.

[0027] The flow of the typical message transmitted and received on the occasion of an update process of a design data is shown in drawing 7 - drawing 9. Drawing 7 is the flow of a message when the architect A who has precedence update rights to a certain design object updates, and the renewal of a design data which Architect A performed using design equipment a is told to share engineering-data-management equipment 2 as an updating demand message. The coordination exchange section 23 which received the updating demand message searches the content of the share engineering-data-management section 21, when it judges that design equipment a has precedence update rights to the design object for updating, it updates a design data as it is, answers a letter in a pseudo update completion message to design equipment a, and makes design equipment a continue a design.

[0028] Moreover, share engineering-data-management equipment 2 transmits an updating informative message to other design equipments b which are referring to the design object for updating, and makes the adjustment to updating perform to design equipment b. Design equipment b answers a letter in an updating acceptance message to share engineering-data-management equipment 2, when the adjustment to updating is completed, it considers that updating completed it when share engineering-data-management equipment 2 received the updating acceptance message, and transmits an updating completion message to design equipment a. Namely, the renewal of a design data which the architect A with precedence update rights performed is promptly reflected in the share engineering-data-management section 21, and, as for the architect A concerned, future designs can be continued immediately. However, updating in this share engineering-data-management section 21 is a virtual state, and when the check of updating acceptance is acquired from other related architects, it is decided.

[0029] Drawing 8 is the flow of a message in case Architect A has only design update rights to a design object, and if the updating demand message of the design data which Architect A performed using design equipment a is told to share engineering-data-management equipment 2, this updating demand message is told to the design equipment b have precedence update rights, and when the updating acceptance message from design equipment b is answered, renewal of the share engineering-data-management section 21 will be performed. However, this updating is a virtual state, answers a letter in a pseudo update completion message to design equipment a, and makes design equipment a continue a design.

[0030] Then, like the case where it is shown in drawing 7, share engineering-data-management equipment 2 transmits an updating informative message to other design equipments c which are referring to the design object for updating, considers that updating completed it when share engineering-data-management equipment 2 received the updating acceptance message from design equipment c, and transmits an updating completion message to design equipment a. That is, the renewal of a design data which the architect A with update rights performed is reflected in the share engineering-data-management section 21 by the acceptance from an architect with precedence update rights, and the architect A concerned can continue future designs. However, updating in this share engineering-data-management section 21 is a virtual state, and when the check of updating acceptance is acquired from

other related architects, it is decided.

[0031] Drawing 9 is the flow of the message at the time of the ability not to obtain consent from other architects, although Architect A had precedence update rights to the design object, and an update process is temporarily made like the case where it is shown in drawing 7 also in this case. However, if the design equipment b which carries out carrier beam relation of the updating informative message fails in adjustment and answers share engineering-data-management equipment 2 in an updating cancellation demand message in this case, in response with share engineering-data-management equipment 2, cancellation processing of updating will be performed.

[0032] In this updating cancellation processing, the design data which the share engineering-data-management section 12 holds is returned to the original content before receiving an updating demand message, and an updating cancellation message is transmitted to design equipment a. Based on this updating cancellation message, with design equipment a, the design data which the local engineering-data-management section 12 holds is returned to the condition before renewal of a design, and redesign is performed. In addition, any of the approach show an architect the content of the message and an architect adjusts as a practice of tuning for the advice of updating of a design and the updating demand of a design, and the approach of establishing an adjustment rule in design equipment and carrying out automatic processing may be adopted.

[0033] Next, an updating demand message is explained with reference to the flow chart which shows processing of the coordination exchange section 23 at the time of a carrier beam to drawing 10. The coordination exchange section 23 will extract the design object for [ corresponding to the message concerned ] updating from the share engineering-data-management section 21, if an updating demand message is received (step S1) (step S2). Subsequently, it judges whether there is any design equipment which refers to the design object for updating in addition to the design equipment which emitted the updating demand message (step S3). Consequently, when other design equipments to refer to cannot be found, after updating the design data which the share engineering-data-management section 21 has managed (step S4), the design equipment which emitted the updating demand message is answered in an updating completion message, and processing is ended (step S5).

[0034] It judges whether on the other hand, when there are other design equipments to refer to, the design equipment which emitted the updating demand message has precedence update rights to the design object for updating (step S6), and in having precedence update rights, it performs the precedence update process shown in drawing 11 (step S7). Moreover, it judges whether in not having precedence update rights, the design equipment which emitted the updating demand message has update rights to the design object for updating (step S8), and in having update rights, it performs the update process shown in drawing 12 non-giving priority (step S9). And when the design equipment which emitted the updating demand message does not have precedence update rights or update rights to the design object for updating, the design equipment concerned is answered in an updating improper message, and processing is ended (step S10).

[0035] In the precedence update process shown in drawing 11, after updating the content of the share engineering-data-management section 21 according to the content of the updating demand message first (step S11), the design equipment which emitted the updating demand message is answered in a pseudo update completion message (step S12). Subsequently, an updating informative message is transmitted to all the design equipments that have update rights to the design object for updating (step S13), and the reply from these design equipment is received (step S14). Subsequently, on the other hand (step S16), when whether all design equipments have consented to updating judges (step S15) and these replies do not consent, when [ which performs updating cancellation processing shown in drawing 13 ] consenting, an updating completion message is transmitted to the design equipment which emitted the updating demand message, and processing is ended (step S17).

[0036] In the update process shown in drawing 12 non-giving priority, an updating demand message is transmitted to the design equipment which has precedence update rights to the design object for updating first (step S21), and the reply to the updating demand message concerned is received (step S22). When whether design equipment with precedence update rights has consented to updating judges

(step S23) and this reply does not consent, an updating improper message is transmitted to the design equipment which emitted the updating demand message, and processing is ended (step S24). On the other hand, when consenting, the same processing as the above-mentioned precedence update process (steps S11-S17) is performed, and processing is ended (steps S25-S31).

[0037] In the updating cancellation processing shown in drawing 13, processing which returns the content of the share engineering-data-management section 21 and the related content of the local engineering-data-management section 12 of design equipment to the condition before updating without conflict is performed using the hysteresis information on updating which the hysteresis Management Department 22 manages (set of the hysteresis record shown in drawing 6). In addition, the concept of the hysteresis information which the hysteresis Management Department 22 manages is shown in drawing 14, and the hysteresis record 10 for every updating demand from each design equipment 1 is accumulated and managed by time series. In explanation of this updating cancellation processing, the hysteresis record 10 set as the object of updating cancellation is set to R, and by the time updating cancellation processing is made actually, sequential are recording of the hysteresis record new to the newest thing r shall be carried out. And processing returned to the condition before the update process about the hysteresis record R is made is performed by being related even with the hysteresis record R from the newest record r, and performing updating cancellation processing.

[0038] In this updating cancellation processing, the hysteresis record corresponding to the update process for cancellation is first extracted from the hysteresis Management Department 22, and it sets up as a value R (step S41). Subsequently, while initializing the variable L showing the set of the hysteresis record of the update process which performs cancellation processing on the list of empty (step S42), the variable T showing the set of design equipment with the need of carrying out updating cancellation of the content of the local engineering-data-management section 12 corresponding to updating cancellation is initialized on the list of empty (step S43). Subsequently, the newest hysteresis record with the newest time stump is set as a value r (step S44), and an update process of the share engineering-data-management section 21 corresponding to the newest update record r is canceled first (step S45).

[0039] Subsequently, in order to make this cancellation processing reflect in Sets L and T, the hysteresis record r canceled to Variable L is added (step S46), and the set of a design device name (architect name) which is referring to the design object concerning the hysteresis record r canceled to Variable T is added (step S47). And it changes into the hysteresis record in front of [ of the hysteresis record which canceled the value of Variable r ] one (step S48), and a value r is compared with a value R in time (step S49). Consequently, since other hysteresis records exist in before the hysteresis record about the updating demand message for cancellation when a value r is new (recently) from a value R, it is carrying out by repeating the above-mentioned processing (steps S45-S48), and an addition on Lists L and T is performed in the updating cancellation processing list about these hysteresis records.

[0040] And since the addition on Lists L and T was made by the updating cancellation processing list about all the hysteresis records after the hysteresis record R about the updating demand message for cancellation when a value r became older than a value R, the updating cancellation message which attached the set L of a hysteresis record transmits to all the design equipments contained in the element of the list variable T, and processing ends (step S50). Thus, related design equipment can be made to return the content of the local engineering-data-management section 12 to the condition before updating without conflict by sending an updating cancellation message with the set of a hysteresis record to all the design equipments relevant to updating cancellation. In addition, these design equipments can perform efficient redesign by reusing the hysteresis record transmitted on the occasion of redesign.

[0041]

[Effect of the Invention] A concurrency can carry out and each architect can advance a design until mismatching generates also about the design data related mutually, since it was made make the design data in which the share engineering-data-management section carries out integrated management based on the updating hysteresis which the hysteresis Management Department manages, and the design data in which each design equipment carries out individual management return in the coordination computer-aided design concerning this invention when mismatching occurs between design datas as explained

above until it could take consistency. Moreover, at the coordination computer-aided design concerning this invention, since renewal of a design data was adjusted based on update rights and the acceptance from each architect, while permitting continuing a \*\*\*\*\* design activity promptly to the updated design data, a design data can be updated in the form where the intention of each related architect was met.

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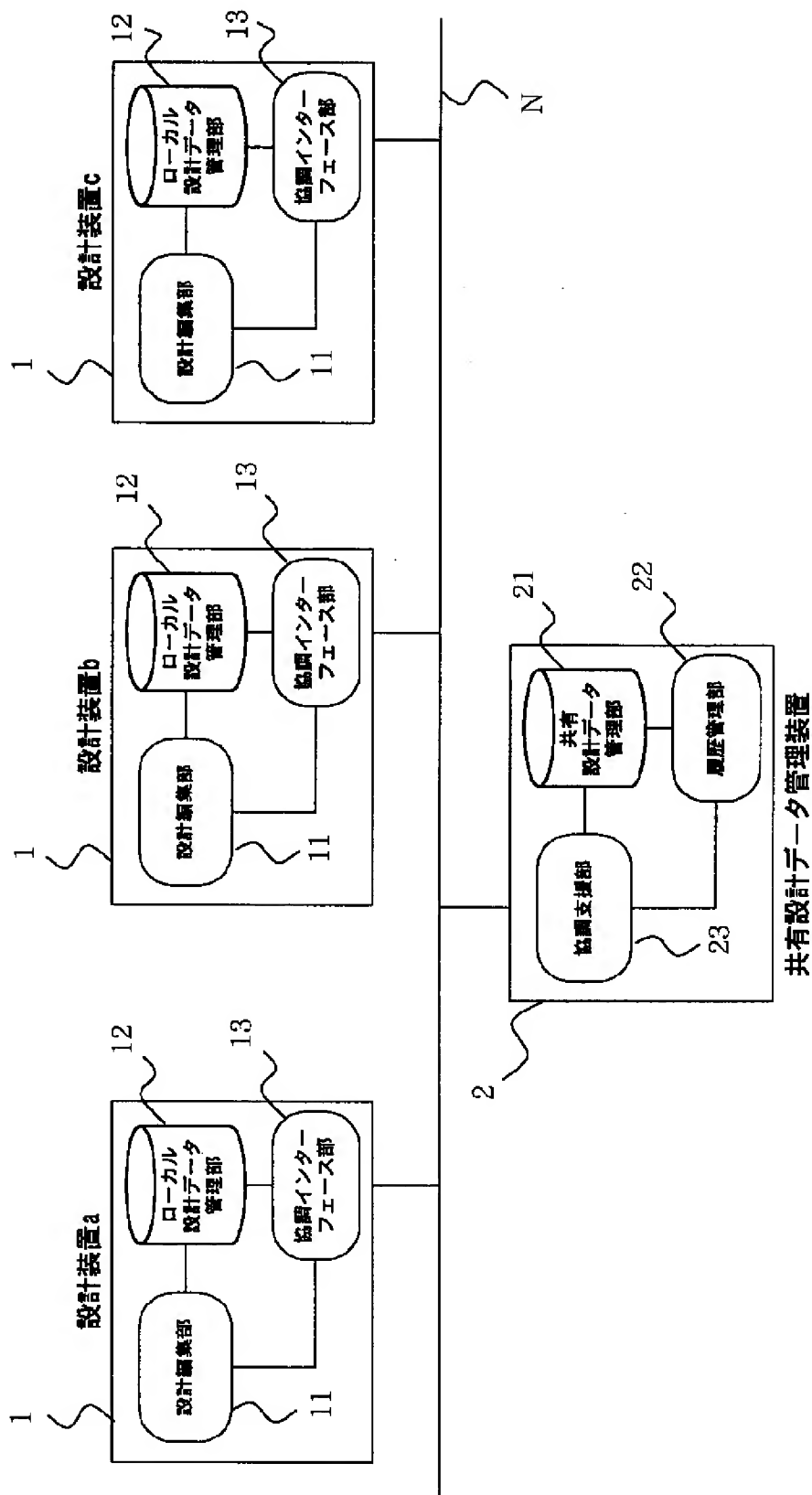
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DRAWINGS

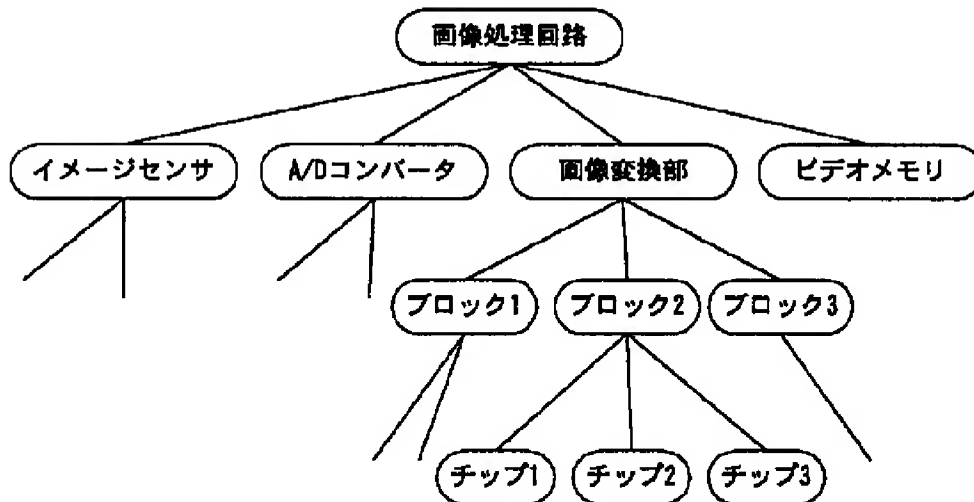
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[Drawing 1]



[Drawing 2]





[Drawing 3]

オブジェクト名	画像変換部
上位オブジェクト	画像処理回路
下位オブジェクト	(ブロック1 ブロック2 ブロック3)
属性	(コスト 5800 変換レート 30 カラー深度 24)

[Drawing 4]

設計者	優先設計オブジェクト	担当設計オブジェクト	参照設計オブジェクト
システム設計者	画像処理回路 (全体) イメージセンサ A/Dコンバータ ビデオメモリ	画像処理回路 (全体) イメージセンサ A/Dコンバータ 画像変換部 ビデオメモリ	画像処理回路 (全体) イメージセンサ A/Dコンバータ 画像変換部 ビデオメモリ
イメージセンサ 設計者		イメージセンサ 画像処理回路 (全体)	イメージセンサ 画像処理回路 (全体)
A/D コンバータ 設計者		A/Dコンバータ 画像処理回路 (全体)	A/Dコンバータ 画像処理回路 (全体)
画像変換部 設計者	画像変換部	画像変換部 画像処理回路 (全体)	画像変換部 画像処理回路 (全体) A/Dコンバータ
ビデオメモリ 設計者		ビデオメモリ 画像処理回路 (全体)	ビデオメモリ 画像処理回路 (全体)

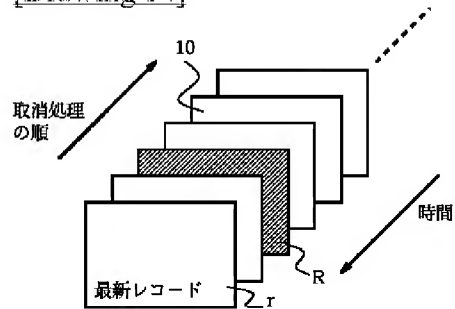
[Drawing 5]

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下位オブジェクト	(ブロック1 ブロック2 ブロック3)
属性	(コスト 5800 変換レート 30 カラー深度 24)
優先更新権保持者	A
更新権保持者	(A B C)
参照者	(A B C E F)

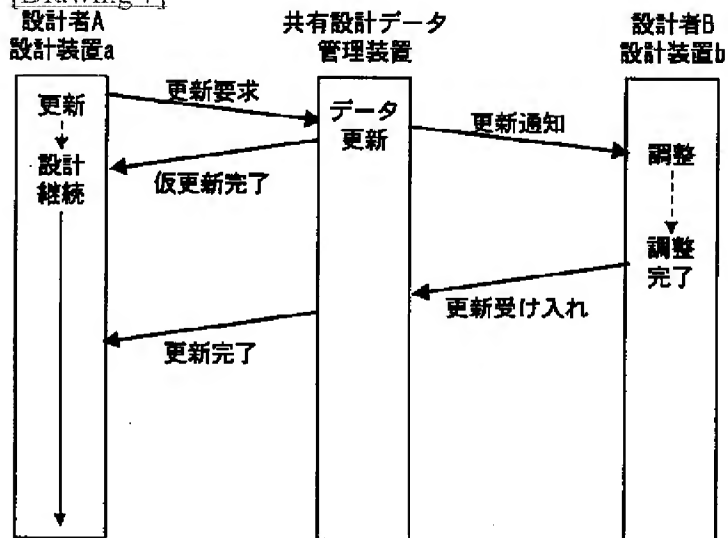
[Drawing 6]

メッセージID	M101
コマンド	変更
オブジェクト	画像変換部
属性	コスト
古い値	5800
変更値	4700
タイムスタンプ	11905)

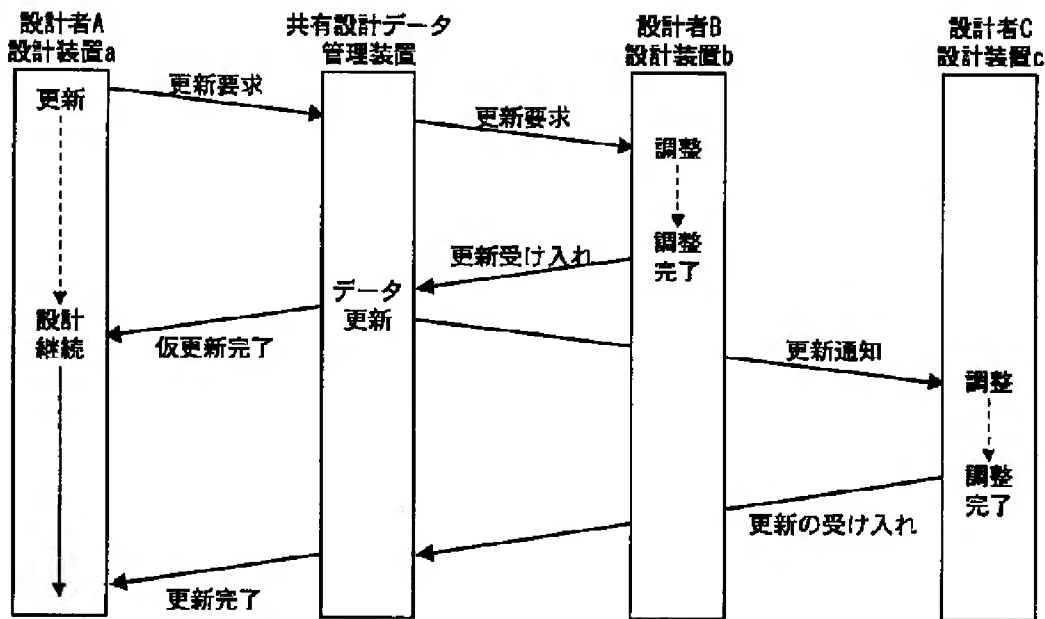
[Drawing 14]



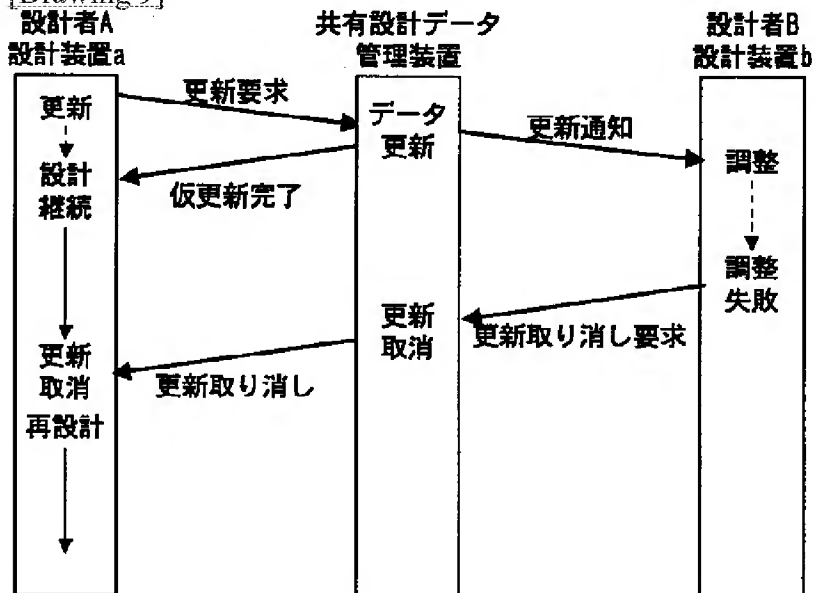
[Drawing 7]



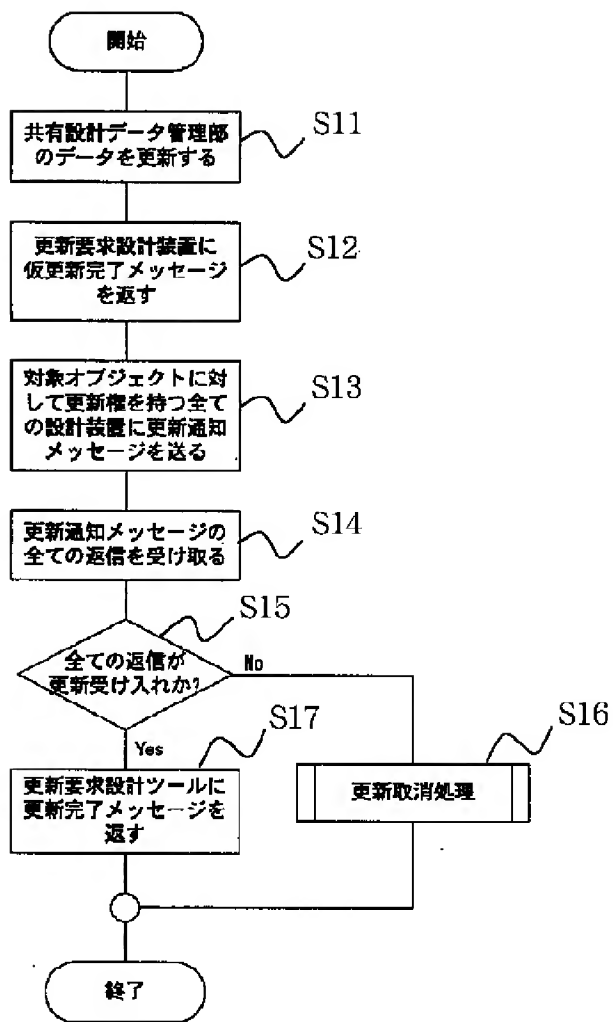
[Drawing 8]



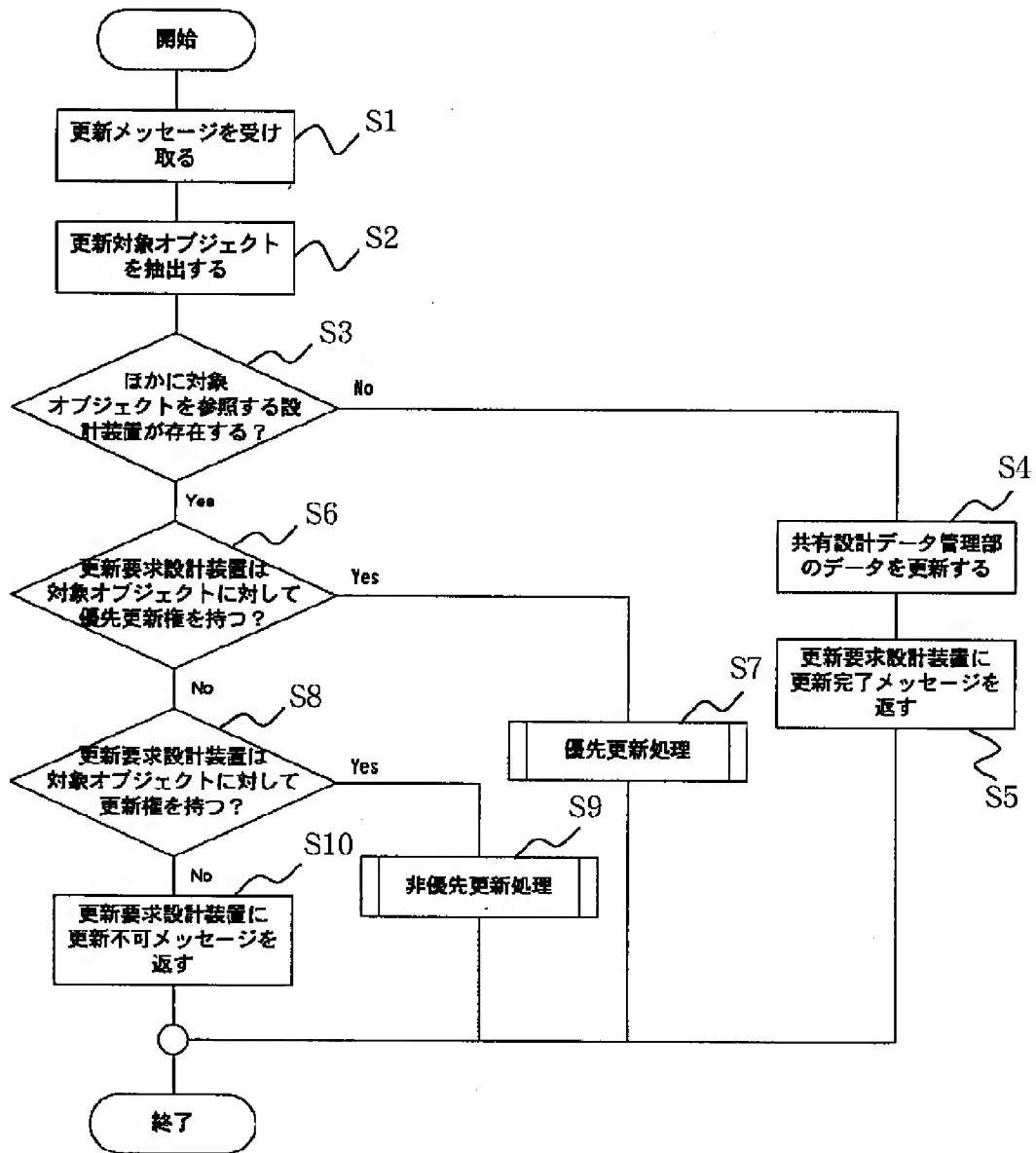
[Drawing 9]



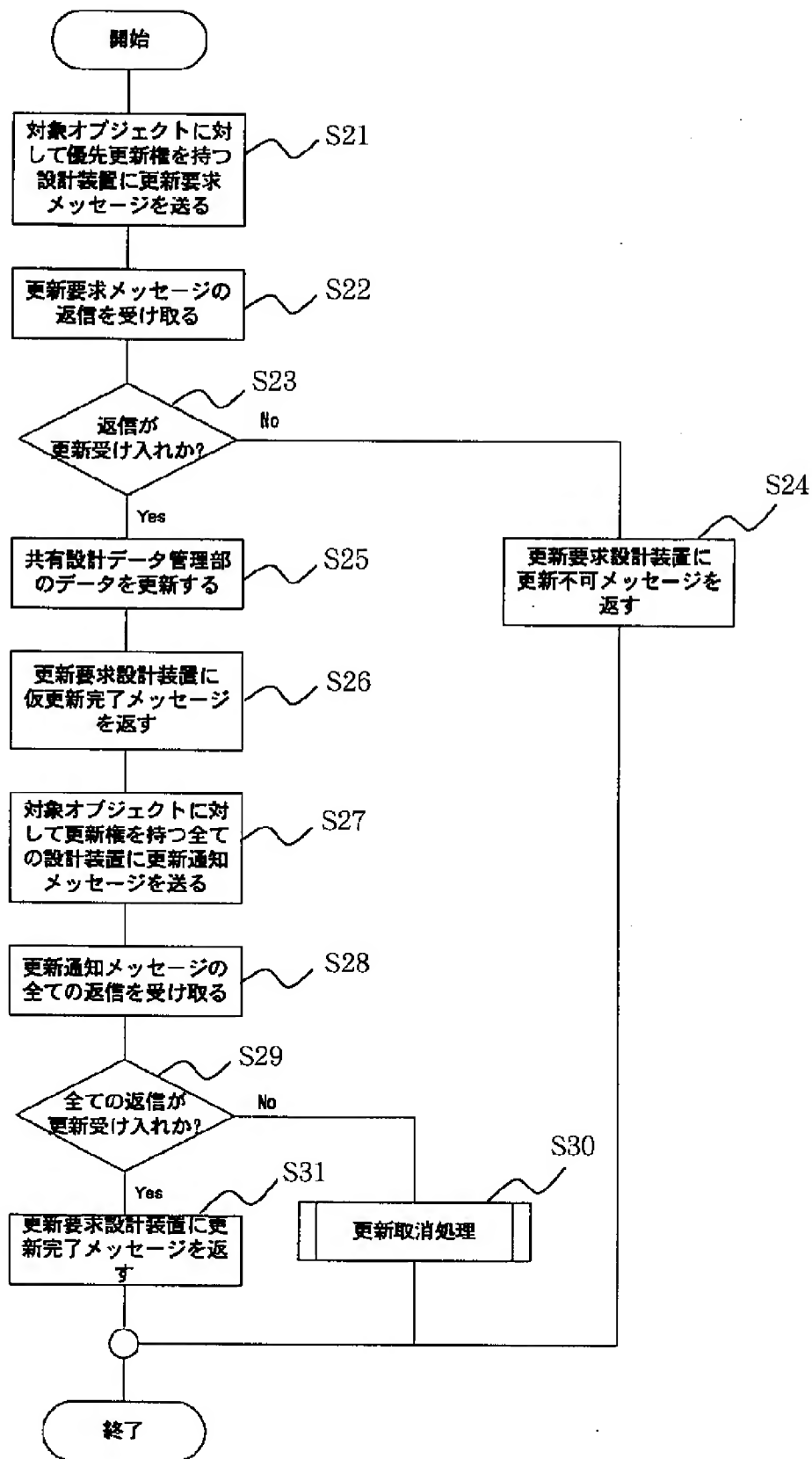
[Drawing 11]



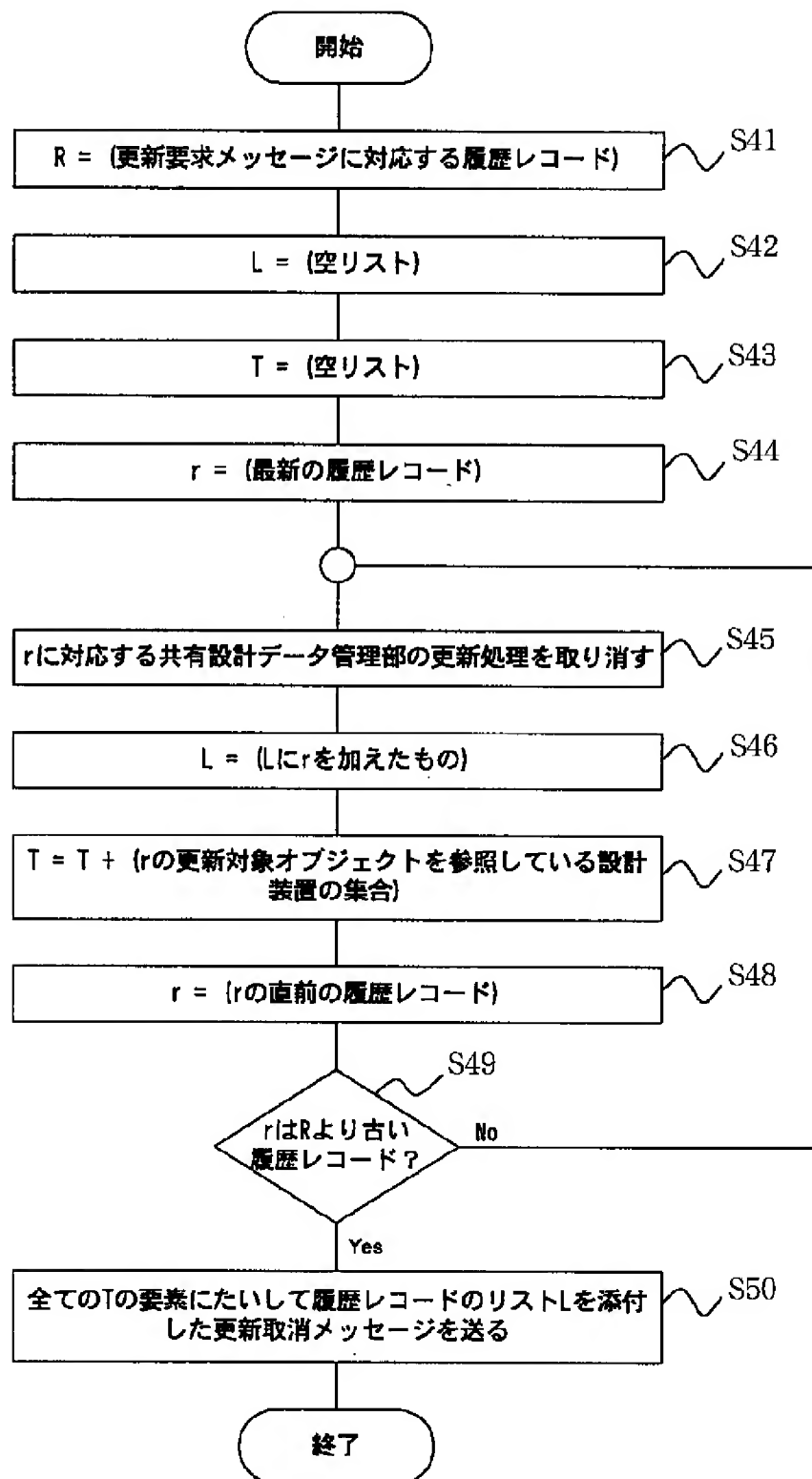
[Drawing 10]



[Drawing 12]



[Drawing 13]



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EFFECT OF THE INVENTION

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[Effect of the Invention] A concurrency can carry out and each architect can advance a design until mismatching generates also about the design data related mutually, since it was made make the design data in which the share engineering-data-management section carries out integrated management based on the updating hysteresis which the hysteresis Management Department manages, and the design data in which each design equipment carries out individual management return in the coordination computer-aided design concerning this invention when mismatching occurs between design datas as explained above until it could take consistency. Moreover, at the coordination computer-aided design concerning this invention, since renewal of a design data was adjusted based on update rights and the acceptance from each architect, while permitting continuing a \*\*\*\*\* design activity promptly to the updated design data, a design data can be updated in the form where the intention of each related architect was met.

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MEANS

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[Means for Solving the Problem] In order to attain the above-mentioned object, it carries out integrated management in the share engineering-data-management section, and makes reference possible in common with each design equipment while carrying out individual management of the design data edited in the coordination computer-aided design of this invention with each design equipment connected through the network with each design equipment, and in updating the design data managed by the share engineering-data-management section, it manages the updating hysteresis in the hysteresis Management Department. And the coordination exchange section has managed adjustment with the design data in which each design equipment carries out individual management, and the design data in which the share engineering-data-management section carries out integrated management, and it is made to return until it can take in consistency the design data the share engineering-data-management section carries out integrated management based on the updating hysteresis which the hysteresis Management Department manages, and the design data each design equipment carries out individual management, when mismatching occurs among these design datas. Therefore, each architect can do a concurrency and can advance a design until mismatching occurs also about the design data related mutually.

[0007] Moreover, in the coordination computer-aided design of this invention, the share engineering-data-management section was divided into the equipment which has the priority of updating for the update rights of the design data which each design equipment edited for every design item, and equipment with the access of updating, and is managed. And after obtaining acknowledgement of updating from other design equipments which refers to the design data concerned in the case of equipment with the access of updating, the share engineering-data-management section makes the design data manage update, while making the design data which the share engineering-data-management section manages promptly update in the case of the equipment in which the design equipment with which the coordination exchange section emitted an updating demand to the renewal demand of a design data from design equipment judges whether they are which said update rights, and has priority. Therefore, while permitting continuing a design promptly based on the design data updated to equipment with priority, although it does not have priority, renewal of a design data is performed in the form where the intention of each architect related to equipment with the access of updating was met.

[0008] moreover, the inquiry to other design equipments refer to the design data concerned further at the coordination computer-aided design of this invention to the renewal demand of a design data from the design equipment the coordination exchange section has the priority of updating -- carrying out -- said -- others -- while canceling said updating, it makes return to the content before updating the design data which notifies the message of updating cancellation to the design equipment which required the updating concerned, and carries out individual management, when the acknowledgement from design equipment is not acquired Therefore, renewal of a design data is performed in the form where the intention of each architect related also to equipment with priority was met.

[0009]

[Embodiment of the Invention] The coordination computer-aided design concerning one example of this invention is explained with reference to a drawing. As shown in drawing 1 , the coordination computer-

aided design of this example has the composition of having connected share engineering-data-management equipment 2 to this network N while connecting two or more design equipments 1 in Network N. In addition, in the following explanation, when each design equipment 1 needs to be distinguished, these design equipment 1 is indicated to be design equipment a, design equipment b, design equipment c, and ...

[0010] Design equipment 1 is constituted by the personal computer with which the design tool program was installed, and it has the design editorial department 11 which performs edit processing of a design data, the local engineering-data-management section 12 which carries out management are recording of the design data in which the design equipment 1 concerned carries out edit charge, and the coordination interface section 13 performed in message switching for taking coordination between design datas. Share engineering-data-management equipment 2 is constituted by the personal computer with which design data management was installed. The share engineering-data-management section 21 to which each design equipment 1 enables in common management are recording of the reference of the design data sent from each design equipment 1, It has the coordination exchange section 23 which manages adjustment with the hysteresis Management Department 22 which manages the hysteresis information on renewal of the design data managed by the share engineering-data-management section 21, and the design data in which each design equipment 1 carries out individual management and the design data in which the share engineering-data-management section 21 carries out integrated management.

[0011] In designing using the coordination computer-aided design of such a configuration, each architect operates each design equipment 1, performs a design of his part in his duty, and performs the editing task of a design data called new creation, modification, etc. of a design data. And deposite of the consistency between the design datas edited with design equipment 1 is realized as follows by share engineering-data-management equipment 2. Each design equipment 1 transmits an updating demand message including the design data concerned to share engineering-data-management equipment 2 through Network N from the coordination interface section 13 while making the design data concerned store in the local engineering-data-management section 12, when a design data is edited.

[0012] This updating demand message is received in the coordination exchange section 23 of share engineering-data-management equipment 2, and while the coordination exchange section 23 makes the design data contained in the updating demand under predetermined conditions reflect in the design data in which the share engineering-data-management section 21 is carrying out generalization management, the design data updated by other related design equipments 1 is attached, and it asks the propriety of updating. In addition, the content of the update process based on the design data which could come, simultaneously was contained in the updating demand message is recorded on the hysteresis Management Department 22 as hysteresis information. And when accepted, while it judges whether an updating demand is acceptable to an inquiry of updating propriety, and the local engineering-data-management section 12 updates the original design data which is carrying out individual management, other related design equipments 1 answer the coordination exchange section 23 in an updating cancellation demand message, when not accepted.

[0013] When the coordination exchange section 23 receives this updating cancellation demand message, the hysteresis information on updating which returns the design data in which the share engineering-data-management section 21 is carrying out management are recording based on the hysteresis information which the hysteresis Management Department 22 has managed, and relates to cancellation with the message of updating cancellation to related design equipment 1 is transmitted. With the design equipment 1 which received this updating cancellation message, the design data managed in the local engineering-data-management section 12 based on the hysteresis information on updating is returned, and consistency with the design data in which the share engineering-data-management section 21 is carrying out management are recording is maintained.

[0014] In addition, when the share engineering-data-management section 2 has managed the update rights of a design data, the priority about update rights is searched about the design equipment 1 with which the coordination exchange section 23 emitted the updating demand of a design data and it has priority, the share engineering-data-management section 21 makes the design data contained in the

updating demand like the above reflect in the design data which is carrying out generalization management promptly in this example. Design data in which the share engineering-data-management section 21 is carrying out generalization management on the other hand in the place with the response which consents to updating from design equipment with priority in not having priority It updates. The disorderly renewal of a design which disregarded the design charge range can be prevented by this, and the effectiveness of a design can be improved.

[0015] Next, the coordination computer-aided design of this example is explained still more concretely taking the case of a design of an electronic circuitry. In addition, also in a machine design etc., the same system configuration and the same procedure can perform the same coordination design. An example of the design data managed in the local engineering-data-management section 13 and the share engineering-data-management section 21 is shown in drawing 2, and this design data is related with an image-processing circuit (object for a design). An image-processing circuit consists of image sensors, an A/D converter, the image transformation section, and four subsystems of video memory. And the image transformation section consists of block 1, block 2, and block 3, and block 2 consists of a chip 1, a chip 2, and a chip 3, for example. In addition, three subsystems other than the image transformation section consist of a block and a chip similarly.

[0016] In this example, each component shown in drawing 2 is called a design object, and an attribute and attribute value are included in this design object. As an attribute, there are cost, an image transformation rate, cost, color depth, etc., for example as a specification of the image transformation section. This design object can be expressed as shown in drawing 3. To the design object of the image transformation section the name "name of image transformation section" and high order object which is element of high order of the image transformation section" image-processing circuit of the object concerned -- " -- image transformation -- the section -- low order -- an element -- it is -- low order -- an object -- a name -- " (block 1, block 2, block 3) -- " -- an attribute -- and -- attribute value -- " (cost 5800, conversion rate 30, color depth 24) -- " -- containing -- having -- \*\*\*\*.

[0017] If here explains housekeeping of the design about an electronic circuitry, a design will usually be performed later on in a design development, outline design, a detail design, and a phase. In a design development phase, the subsystem configuration of the whole system and the decision of a requirement specification item are made, and in the example of the image-processing circuit shown in drawing 2, the requirement specification of a top-level image-processing circuit is determined first, and it opts for the subsystem configuration which fills it. Then, the structure of a system and a specification are determined as condition of determining the block configuration which fulfills the specification of a subsystem, and each specification, and its specification at a top-down. And the electronic parts which realize the block of an electronic circuitry in an outline design phase are determined, and it opts for the connection between electronic parts, and the arrangement on a printed circuit board in a detail-design phase.

[0018] By the way, a design is difficult for requiring various know hows and performing all designs by one person. For this reason, it designs in many cases by two or more architects well versed in various special fields of study assigning. Also in the design of an image-processing circuit, in a design development phase, a system designer takes the lead, and determines a system-wide specification and the outline specification of a subsystem, and the expert of a subsystem, i.e., the expert of image sensors, the expert of an A/D converter, the expert of the image transformation section, etc. perform a block design etc. about each subsystem, for example.

[0019] Thus, when performing a design in the shared range, usually the range mutually shared among architects laps [ certain ] a grade. For example, although a system designer with specification decisive power takes the lead and determines a specification in the specification decision of the image transformation section, since verification of the specification taken into consideration to the implementation level of a circuit cannot be judged if it is not the expert of the image transformation section, the expert of the image transformation section may change a specification. Furthermore, it faces carrying out a design and it is necessary to refer to design datas other than one's design range. For this reason, in the share engineering-data-management section 21 of share engineering-data-management equipment 2, the design datas including the assignment range and reference range between the architects

who mentioned above shared with design equipment a, design equipment b, and design equipment c are managed.

[0020] It classifies and the assignment range and reference range between architects are specifically managed, as shown in drawing 4, and the design object which each architect can access is classified into the precedence design object, the design object in its duty, and the reference design object from the high order. A precedence design object is a design object in which an architect has update rights preferentially, and each design object is registered into any one architect as a precedence design object. The design object in its duty is a design object in which an architect has update rights as range for a design, and a precedence design object is also the design object in its duty. A reference design object is a design object which an architect refers to at the time of a design, and the design object in its duty is also a reference design object. That is, the design object in their duty and a reference design object overlap among architects.

[0021] In the example shown in drawing 4, all architects have design update rights and design object "image-processing circuit (whole)" is registered as a design object in its duty. Moreover, design object "A/D converter" is registered as an object which a system designer, an A/D converter architect, and an image-processing section architect refer to. In addition, the design object (namely, a precedence design object, the design object in its duty, and a reference design object) to the reference range of the architect using the design equipment 1 is managed by the local engineering-data-management section 12 of each design equipment 1.

[0022] The assignment range and reference range between such architects were matched with the design object, and the share engineering-data-management section 21 has managed them, as shown in drawing 5. drawing 5 -- being shown -- an example -- image transformation -- the section -- about -- a design -- an object -- it is -- precedence -- a design -- an object -- \*\*\*\*\* -- being concerned -- a design -- an object -- accessing -- an architect -- " -- A -- " -- precedence -- update rights -- a holder -- charge -- a design -- an object -- \*\*\*\*\* -- being concerned -- a design -- an object -- accessing -- an architect -- " (AB C) -- " -- update rights -- a holder -- reference -- a design -- an object -- \*\*\*\*\* -- being concerned -- a design -- an object -- accessing -- an architect -- " (A B C E F) -- " -- reference -- a person -- \*\* -- carrying out -- an attribute -- holding -- \*\*\*\*.

[0023] Moreover, in order that the hysteresis Management Department 22 may manage the hysteresis about renewal of a design data, hysteresis information is managed, and hysteresis information serves as a set of the hysteresis record for every updating demand message. The hysteresis record contains the class (command) of update processes, such as an identifier (message ID) of an updating demand message, modification, an addition, and deletion, the design object name for updating (object), the original value (old value) of the updated attribute value, the attribute value after updating (modification value), and the generating time of day (time stamp) of an updating demand message, as shown in drawing 6. In the example of the hysteresis record shown in drawing 6, the updating demand message of ID "M101" is emitted by time-of-day "11905", and it is managed that design object "attribute of image transformation section" cost" was changed into "4700" from "5800."

[0024] Next, actuation of the coordination computer-aided design concerning this example is explained. First, a design can be advanced in the situation which the mismatching between design datas has not generated, without each architect being conscious of other architects' thing in coordination computer-aided design. As for Architect A, in Architect B, in the following explanation, each one performs editing tasks, such as an addition of a design data, modification, and deletion, through the design editorial department 11 using design equipment c using design equipment b using design equipment a, as for Architect C. For example, if Architect A edits a design data using design equipment a, this content of edit will be told to share engineering-data-management equipment 2 by the updating demand message from the coordination interface section 13 while it is reflected in the local engineering-data-management section 12 of design equipment a. In addition, the coordination interface section 13 will be in the condition of waiting for reply messages, such as pseudo update completion, the completion of updating, updating improper, and updating cancellation, from share engineering-data-management equipment 4, after transmitting an updating demand message.

[0025] With the share engineering-data-management equipment 2 which received the updating demand message, the coordination exchange section 23 collates with the design data which analyzes the updating demand message concerned and is saved in the share engineering-data-management section 21, and chooses one processing of the following (1) - (3) based on the access of design equipment (namely, architect using design equipment) to the design object for updating.

(1) When design equipment has precedence update rights to a design object, update the content of the share engineering-data-management section 21, and transmit the message of a purport by which the update process was made to the design equipment which is referring to the design object. In addition, since the update process was made, the design equipment which emitted the updating demand message will continue future designs, and can perform it.

[0026] (2) Transmit an updating demand message to the design equipment which has precedence update rights when design equipment has only update rights to a design object, only when design equipment with precedence update rights recognizes, update the content of the share engineering-data-management section 21, and transmit a message in the purport by which the update process was made by the design equipment which is referring to the design object. In addition, the design equipment which emitted the message until acknowledgement was acquired will interrupt a design.

(3) When design equipment does not have update rights, transmit to the design equipment concerned by making into an updating improper message the purport updating is not accepted to be. In addition, the content of updating of such a design data is saved as a hysteresis record at the hysteresis Management Department 22, when a claim is attached from other than the design equipment which has precedence update rights to renewal of a design data, it is returned to the content before updating a design data using the hysteresis record saved at the hysteresis Management Department 22, and redesign is urged to it.

[0027] The flow of the typical message transmitted and received on the occasion of an update process of a design data is shown in drawing 7 - drawing 9. Drawing 7 is the flow of a message when the architect A who has precedence update rights to a certain design object updates, and the renewal of a design data which Architect A performed using design equipment a is told to share engineering-data-management equipment 2 as an updating demand message. The coordination exchange section 23 which received the updating demand message searches the content of the share engineering-data-management section 21, when it judges that design equipment a has precedence update rights to the design object for updating, it updates a design data as it is, answers a letter in a pseudo update completion message to design equipment a, and makes design equipment a continue a design.

[0028] Moreover, share engineering-data-management equipment 2 transmits an updating informative message to other design equipments b which are referring to the design object for updating, and makes the adjustment to updating perform to design equipment b. Design equipment b answers a letter in an updating acceptance message to share engineering-data-management equipment 2, when the adjustment to updating is completed, it considers that updating completed it when share engineering-data-management equipment 2 received the updating acceptance message, and transmits an updating completion message to design equipment a. Namely, the renewal of a design data which the architect A with precedence update rights performed is promptly reflected in the share engineering-data-management section 21, and, as for the architect A concerned, future designs can be continued immediately. However, updating in this share engineering-data-management section 21 is a virtual state, and when the check of updating acceptance is acquired from other related architects, it is decided.

[0029] Drawing 8 is the flow of a message in case Architect A has only design update rights to a design object, and if the updating demand message of the design data which Architect A performed using design equipment a is told to share engineering-data-management equipment 2, this updating demand message is told to the design equipment b have precedence update rights, and when the updating acceptance message from design equipment b is answered, renewal of the share engineering-data-management section 21 will be performed. However, this updating is a virtual state, answers a letter in a pseudo update completion message to design equipment a, and makes design equipment a continue a design.

[0030] Then, like the case where it is shown in drawing 7, share engineering-data-management



equipment 2 transmits an updating informative message to other design equipments c which are referring to the design object for updating, considers that updating completed it when share engineering-data-management equipment 2 received the updating acceptance message from design equipment c, and transmits an updating completion message to design equipment a. That is, the renewal of a design data which the architect A with update rights performed is reflected in the share engineering-data-management section 21 by the acceptance from an architect with precedence update rights, and the architect A concerned can continue future designs. However, updating in this share engineering-data-management section 21 is a virtual state, and when the check of updating acceptance is acquired from other related architects, it is decided.

[0031] Drawing 9 is the flow of the message at the time of the ability not to obtain consent from other architects, although Architect A had precedence update rights to the design object, and an update process is temporarily made like the case where it is shown in drawing 7 also in this case. However, if the design equipment b which carries out carrier beam relation of the updating informative message fails in adjustment and answers share engineering-data-management equipment 2 in an updating cancellation demand message in this case, in response with share engineering-data-management equipment 2, cancellation processing of updating will be performed.

[0032] In this updating cancellation processing, the design data which the share engineering-data-management section 12 holds is returned to the original content before receiving an updating demand message, and an updating cancellation message is transmitted to design equipment a. Based on this updating cancellation message, with design equipment a, the design data which the local engineering-data-management section 12 holds is returned to the condition before renewal of a design, and redesign is performed. In addition, any of the approach show an architect the content of the message and an architect adjusts as a practice of tuning for the advice of updating of a design and the updating demand of a design, and the approach of establishing an adjustment rule in design equipment and carrying out automatic processing may be adopted.

[0033] Next, an updating demand message is explained with reference to the flow chart which shows processing of the coordination exchange section 23 at the time of a carrier beam to drawing 10. The coordination exchange section 23 will extract the design object for [ corresponding to the message concerned ] updating from the share engineering-data-management section 21, if an updating demand message is received (step S1) (step S2). Subsequently, it judges whether there is any design equipment which refers to the design object for updating in addition to the design equipment which emitted the updating demand message (step S3). Consequently, when other design equipments to refer to cannot be found, after updating the design data which the share engineering-data-management section 21 has managed (step S4), the design equipment which emitted the updating demand message is answered in an updating completion message, and processing is ended (step S5).

[0034] It judges whether on the other hand, when there are other design equipments to refer to, the design equipment which emitted the updating demand message has precedence update rights to the design object for updating (step S6), and in having precedence update rights, it performs the precedence update process shown in drawing 11 (step S7). Moreover, it judges whether in not having precedence update rights, the design equipment which emitted the updating demand message has update rights to the design object for updating (step S8), and in having update rights, it performs the update process shown in drawing 12 non-giving priority (step S9). And when the design equipment which emitted the updating demand message does not have precedence update rights or update rights to the design object for updating, the design equipment concerned is answered in an updating improper message, and processing is ended (step S10).

[0035] In the precedence update process shown in drawing 11, after updating the content of the share engineering-data-management section 21 according to the content of the updating demand message first (step S11), the design equipment which emitted the updating demand message is answered in a pseudo update completion message (step S12). Subsequently, an updating informative message is transmitted to all the design equipments that have update rights to the design object for updating (step S13), and the reply from these design equipment is received (step S14). Subsequently, on the other hand (step S16),

when whether all design equipments have consented to updating judges (step S15) and these replies do not consent, when [ which performs updating cancellation processing shown in drawing 13 ] consenting, an updating completion message is transmitted to the design equipment which emitted the updating demand message, and processing is ended (step S17).

[0036] In the update process shown in drawing 12 non-giving priority, an updating demand message is transmitted to the design equipment which has precedence update rights to the design object for updating first (step S21), and the reply to the updating demand message concerned is received (step S22). When whether design equipment with precedence update rights has consented to updating judges (step S23) and this reply does not consent, an updating improper message is transmitted to the design equipment which emitted the updating demand message, and processing is ended (step S24). On the other hand, when consenting, the same processing as the above-mentioned precedence update process (steps S11-S17) is performed, and processing is ended (steps S25-S31).

[0037] In the updating cancellation processing shown in drawing 13 , processing which returns the content of the share engineering-data-management section 21 and the related content of the local engineering-data-management section 12 of design equipment to the condition before updating without conflict is performed using the hysteresis information on updating which the hysteresis Management Department 22 manages (set of the hysteresis record shown in drawing 6 ). In addition, the concept of the hysteresis information which the hysteresis Management Department 22 manages is shown in drawing 14 , and the hysteresis record 10 for every updating demand from each design equipment 1 is accumulated and managed by time series. In explanation of this updating cancellation processing, the hysteresis record 10 set as the object of updating cancellation is set to R, and by the time updating cancellation processing is made actually, sequential are recording of the hysteresis record new to the newest thing r shall be carried out. And processing returned to the condition before the update process about the hysteresis record R is made is performed by being related even with the hysteresis record R from the newest record r, and performing updating cancellation processing.

[0038] In this updating cancellation processing, the hysteresis record corresponding to the update process for cancellation is first extracted from the hysteresis Management Department 22, and it sets up as a value R (step S41). Subsequently, while initializing the variable L showing the set of the hysteresis record of the update process which performs cancellation processing on the list of empty (step S42), the variable T showing the set of design equipment with the need of carrying out updating cancellation of the content of the local engineering-data-management section 12 corresponding to updating cancellation is initialized on the list of empty (step S43). Subsequently, the newest hysteresis record with the newest time stump is set as a value r (step S44), and an update process of the share engineering-data-management section 21 corresponding to the newest update record r is canceled first (step S45).

[0039] Subsequently, in order to make this cancellation processing reflect in Sets L and T, the hysteresis record r canceled to Variable L is added (step S46), and the set of a design device name (architect name) which is referring to the design object concerning the hysteresis record r canceled to Variable T is added (step S47). And it changes into the hysteresis record in front of [ of the hysteresis record which canceled the value of Variable r ] one (step S48), and a value r is compared with a value R in time (step S49). Consequently, since other hysteresis records exist in before the hysteresis record about the updating demand message for cancellation when a value r is new (recently) from a value R, it is carrying out by repeating the above-mentioned processing (steps S45-S48), and an addition on Lists L and T is performed in the updating cancellation processing list about these hysteresis records.

[0040] And since the addition on Lists L and T was made by the updating cancellation processing list about all the hysteresis records after the hysteresis record R about the updating demand message for cancellation when a value r became older than a value R, the updating cancellation message which attached the set L of a hysteresis record transmits to all the design equipments contained in the element of the list variable T, and processing ends (step S50). Thus, related design equipment can be made to return the content of the local engineering-data-management section 12 to the condition before updating without conflict by sending an updating cancellation message with the set of a hysteresis record to all the design equipments relevant to updating cancellation. In addition, these design equipments can



perform efficient redesign by reusing the hysteresis record transmitted on the occasion of redesign.

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[Translation done.]

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PRIOR ART

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[Description of the Prior Art] When two or more architects do a concurrency and advance a design using two or more design equipments (design tool) connected in the network, in order to take adjustment between the design datas (the content of a design) each architect edited by performing new creation, correction, etc., it is necessary to transmit the design data edited with each design equipment to other design equipments. Although transfer of such a design data was performed in the form of a document or CAD data for every design phase in the former, since effectiveness is bad, now, the method automatically transmitted between design equipment in parallel to progress of a design is proposed. [0003] For example, the integrated-database management equipment which carries out unitary management of the design data used with all design tools is formed in JP,6-176084,A, and by making integrated-database management equipment access all design tools, while losing the design duplication of data, the packaging-design exchange equipment which abolishes generating of the mismatching between design datas is proposed. Moreover, if a design data is edited by each design equipment, based on the constraint set up beforehand, the coordination die design management network system which makes the interlocking correction of the design data to which it relates on a share database, and aims at coordination between design datas is proposed by JP,5-12354,A.

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the coordination computer-aided design which supports that two or more architects do a concurrency using two or more design equipments connected in the network, and advance a design.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, if it is in the above-mentioned packaging-design exchange equipment, in order to prevent the mismatching between design datas, while a certain design tool was performing the design, from other design tools, the design data which the design tool makes applicable to edit could not be updated, and needed to be carried out. For this reason, although the design of the range in which a design data does not interfere could be simultaneously advanced in other design tools while a certain design tool was performing the design, the design about the design data of the range in which it interferes needed to be interrupted, and the efficient coordination design activity was not able to be done. Moreover, if it was in the above-mentioned coordination die design management network system, since the automatic update process based on constraint was performed, the problem that correction will reach even the range of a design data in which renewal of the design data which an architect does not mean is performed from other design tools, and a data area originally does not lap with an architect depending on the method of a design about [ producing confusion ] and constraint was.

[0005] It aims at offering the coordination computer-aided design which this invention was made in view of the above-mentioned conventional situation, and each architect can do a concurrency also about the design data related mutually, and can advance a design. Moreover, this invention aims at offering the coordination computer-aided design to which renewal of a design data is performed in the form where the intention of each architect was met.

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[Translation done.]